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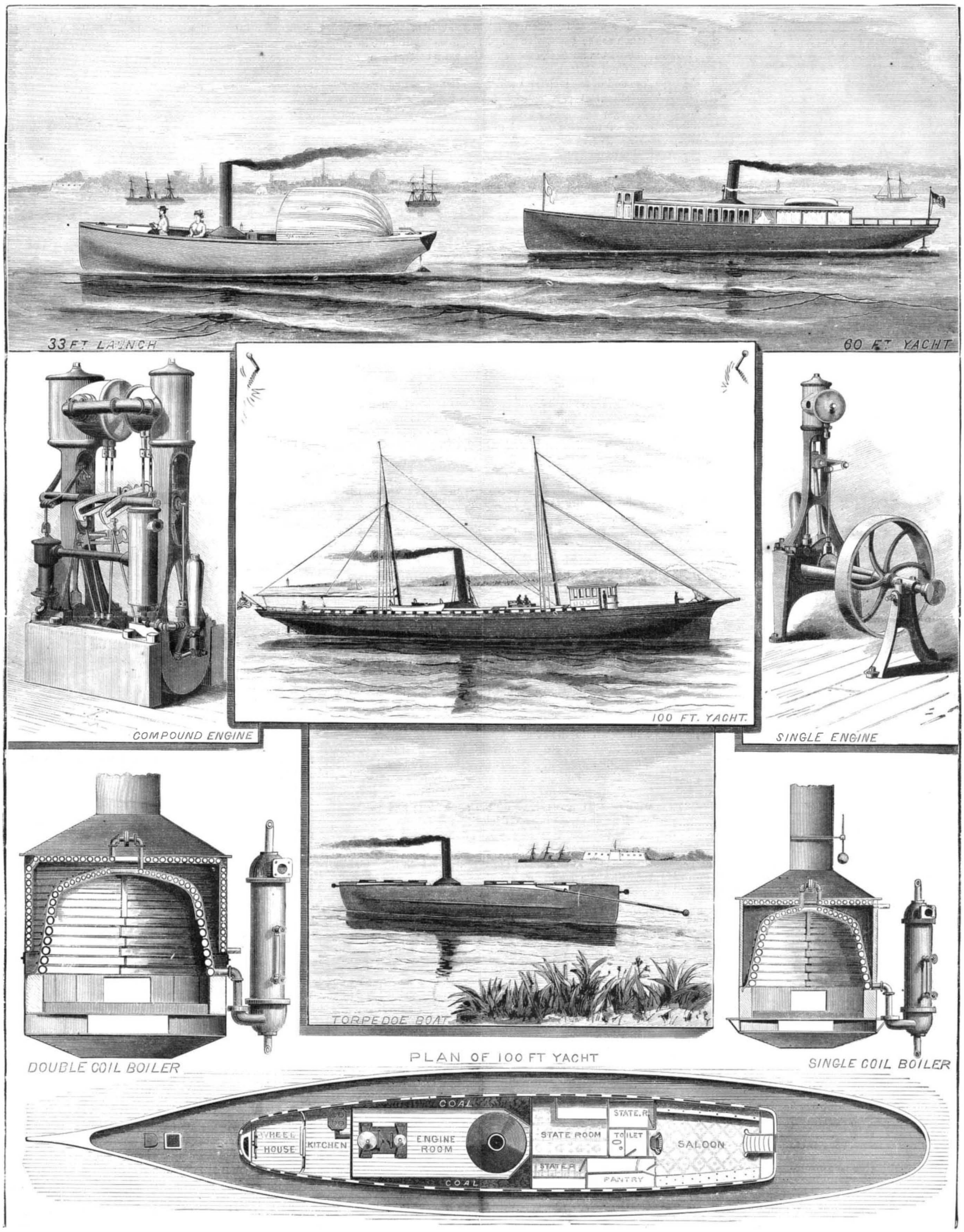

THE HERRESHOFF TORPEDO-BOAT, STEAM LAUNCH, BOILER AND ENGINE.—[See page 99.]

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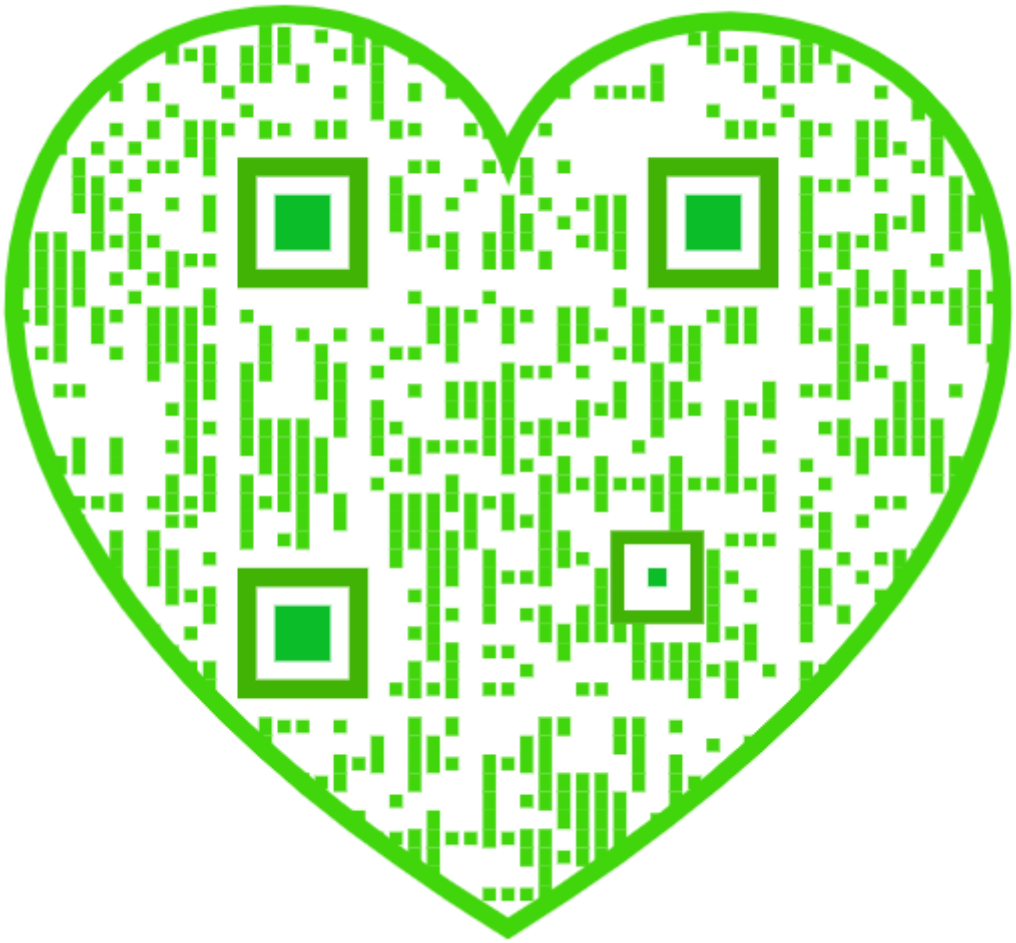

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PROGRESS OF PATENT LAW.

A prominent subject in the decisions recently reported is the degree of "invention" needful to support a patent. Patents must be new and useful; the rule is elementary; yet it does not seem—if one may judge from the number of cases in the courts—to be generally understood. The case of the whip tip patent is a striking illustration, for the reason that the invention, so to call it, was really useful, and the judge in deciding against it, said that he was sorry to do so, as the inventor had introduced a real improvement in the trade. This inventor had observed that driving whips, especially long ones without a lash, were expensive because they soon became frayed or broken at the tip end; while the stock remained good, the whole was worthless for defect of the tip. His device for relieving this difficulty was to make whip tips independent of stocks, so that they might be replaced when worn out. Each tip had a socket, which might be fitted to the small end of the stock very much as the successive lengths of a fishing rod are inserted one within another, except that he cut a screw thread on the inside of the socket of the tip, corresponding to one outside the end of the stock, by which the two might be held firmly together. A patent was obtained; but soon a rival began selling whip tips so contrived as to be clinched to the ferrule of the stock instead of being screwed. There was a law suit; and the court decided that the claim of exclusive right to make independent tips could not be maintained because it was not new. Fishing rods have been made for years upon the same principle. To be sure they have not been screwed together, and the patentee of the whip tips was pronounced entitled to his screw. But the competing company was not using a screw; therefore it was allowed to continue the business.

A more recent case is that of the "perfection window cleaner." The description of it is long and complex; but the device was substantially a rubber mounted upon a long handle, adapted to be used in reaching up to clean window panes and other glass surfaces. It consisted only in the adjustment of the rubber strip, supported by a tubular cushion, in a way to bring it advantageously against the surface to be cleaned. The decision of the court was that there was nothing new in the invention; the implement was nothing but a mop or scrubbing brush made of India-rubber.

A still more remarkable case was decided upon a patent for "improved kindling wood." In order to make kindling wood take fire easily and save the kitchen maids the trouble of cutting splinters and shavings, or of hunting for waste paper to set it alight, this inventor proposed to sell the wood in small bundles, in each of which should be tied a little lump of resin, tar, or some combustible of that sort, which would take fire from a common match, and set fire to the bundle. For this he obtained a patent, but the court said that there was no invention; his device was no more than selling tar or resin tied up in a bundle with kindling wood. It was no more patentable than would be selling a cigar with a match tied to it, or a drinking glass with a straw, or a can of food with a fork.

City readers are familiar with the fare boxes used in omnibuses, and in the street cars running unaccompanied by conductors. They are so arranged that a passenger may drop the coin for his fare into a sort of savings bank slit at the top of the apparatus, through which the coin will fall down upon a little movable shelf—what one might perhaps call a diaphragm—where it lies until the driver has inspected it to see that it is a genuine coin, is for the proper amount, etc. He then pulls a lever, which lets the shelf drop, and the coin falls into the company's savings bank below. Obviously the device requires a window for the driver to look through. Fare boxes as thus described have been in use for some time. Patents were more recently taken out for two improvements. One of these consisted in fitting a second window to the rear side of the apparatus; and the other consisted in arranging a reflector in the interior of the box, so that the headlight of the car might shine down and enable the coins to be seen conveniently at night. The Circuit Court has decided against the validity of both these claims. Inserting the additional window is nothing new; the old form of the box included one window, so that the improvement consisted merely in duplicating one of the features of a former device. This is not "invention;" nor is any invention involved in arranging a reflector near a lamp in such a manner as to cast light into a fare box near by it.

Seats for chairs, settees, railroad cars, ferryboat cabins, etc., are nowadays extensively made of veneers, or thin sheets of wood perforated. Strength is gained for the thin wood by gluing one sheet upon another crosswise, and the perforations, being arranged upon some simple design, give both ventilation and ornament. A patent was taken out for this mode of construction; but when it was contested, proof was produced of an earlier patent for gluing veneers together across their grains to make a thin, strong sheet; and also of another earlier patent for perforating sheet metal for making chair bottoms. The Circuit Court then said that the more recent patent for veneers glued together and perforated displayed no invention, and was void.

In two law suits which arose upon the patent for the giant powder, it became necessary to consider the question, How full and precise must be the description of a device in an earlier patent in order to forbid one who invents it anew at a later date from obtaining a valid patent? Judge Blatchford has stated the rule to be that the description in the prior patent must be sufficient to show with certainty how, by following its directions, the article can be made, and this must be a result within the intention of the description, not a mere accident. Showing that by following the directions of an earlier patent, a person might accidentally, through small variations in the process, have hit upon the same result, does not avoid a patent which has been granted to a subsequent inventor.

A noteworthy decision in this branch of the law, in which the patentee was more successful than in the preceding cases, relates to an improvement in water works for cities. Former devices for this purpose have been subject to the defect that the pressure of water from reservoirs, or from force pumps where they were employed, upon hydrants or spigots, was inconveniently variable; sometimes it would be deficient, and then so excessive as to burst the apparatus. The inventor devised pumping machinery so contrived that as fast as the pumps increased the quantity of water in the mains, and so increased the pressure upon the hydrants or spigots, the increased pressure should diminish the action of the pumps automatically; or, afterward, when the flow of water from use diminished the pressure, the diminution should set the pumps at work again more vigorously. The invention has been quite widely adopted. Recently the patentee's priority has been contested, and several English and American contrivances, having the same general purpose, have been brought forward for comparison, but the Circuit Court, after examining them in detail, pronounced them all substantially different and inferior, and sustained the patent.

THE SURPLUS PATENT FUNDS.

In 1868 Congress passed a law requiring the daily receipts of the Patent Office to be deposited in the Treasury, the support of the office to be provided for by annual appropriations from the patent fund. During recent years, under a pretext of economy, the appropriations for the conduct of the Patent Office have been unduly cut down, greatly to the disadvantage of the service, while the surplus fees have accumulated until they now amount to over sixteen hundred thousand dollars. In other words, the inventors of the country have paid in fees to the office, during the past ten or twelve years, this large sum in excess of the cost of the service rendered by the office.

There has naturally arisen the question, What shall be done with these surplus funds?

It is obvious that the most that can be asked of any branch of the public service is that it shall accomplish efficiently and fully the work intended by it. If the fees paid for service by those who are served amount to enough to pay the cost of such efficient service, that is so much more to its credit, and the utmost that can be justly demanded of it has been secured. The only department of the public service which stands in this unique position is the Patent Office. It has been and is self-supporting—and more.

If in doing this it has also done its legitimate work with the highest degree of efficiency justice to the clients of the office, the patentees, demands that the fees should be cut down so as to cover the cost of the service, and no more. If the office has been prevented, through insufficient appropriations, from doing its work as well as it might, and this is plainly the case, the only alternative is to use the surplus fees for the immediate improvement of the service.

Any diversion of the surplus funds to other uses—as proposed in the bill lately passed by the Senate and now pending in the House, transferring the surplus funds of the Patent Office to an educational fund—is equivalent to laying a special tax upon inventors, which is certainly neither fair nor politic.

If the excess of fees cannot be used for the improvement of the Patent Service, there should be no excess of fees. Indeed, justice to our inventors, and a wise national policy looking to the advancement of the useful arts and sciences through the encouragement of invention, plainly indicate two things to be done in this connection:

1st. The passage of Mr. Vance's bill to reduce the fees on patents and caveats, or something like it; and

2d. The employment of the surplus fund now accumulated to improve the working facilities of the Patent Office. The office needs more room to work in; its library should be extended and classified as to matter and thoroughly indexed; a critical digest of the patents that have been issued should be made for the convenience of the public as well as that of the office; and all the patents issued before 1866 should be printed and made accessible to students and inventors at reasonable cost. This done, it is quite possible that the fees named in Mr. Vance's bill would suffice to cover the running expenses of the office with an efficiency of service impossible now, and still less possible should the office have to submit to a diminished income without the improved facilities which a proper use of the surplus funds would secure.

Burnt Clay for Railroad Ballasting.

The Chicago, Burlington, and Quincy Railroad Company are burning clay for ballasting their road. A small fire of bituminous Iowa coal is started on the surface of the ground, and, when burning freely, the fire is covered with a layer of lumpy clay, then alternately coal and clay, the coal decreasing in quantity until at the top it is as one to fifteen. The mass is formed like a cone. Three united cones, each 18 feet high and containing in all about 1,000 cubic yards of material, have been started near Red Oak. They will burn for months. Six hundred miles of road are to be ballasted with this crude pottery broken up. It resembles coal cinder, but is harder.

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THE NATURAL HISTORY OF THE JEWS.

In recent issues of the SCIENTIFIC AMERICAN SUPPLEMENT there have appeared several articles with regard to the distribution, numbers, anatomical characteristics, etc., of the Jewish race, a race, we may add, which we hold in high respect for its vitality, energy, thrift, intellectual force, and, under favorable conditions, high moral worth. The last article, in the issue of January 1, contains an interesting comparison of the physical measurements of Russian Jews with corresponding measurements of other races inhabiting the dominion of the Czar.

The measurements were made by Dr. G. Schultz, Conservator of the Anatomical Museum of St. Petersburg, and indicate that the racial characteristics of Oriental Jews are as strongly shown in their physique as in their social and religious customs.

Unfortunately the writer, manifestly biased by the anti-Jewish craze which is showing itself so discreditably in certain parts of Europe, went on to assert that the bodily peculiarities of the Jews were accompanied by and served to account for certain alleged mental and moral traits the reverse of honorable. The incorrectness and injustice of these assumptions are pointed out very forcibly in the current issue of the SUPPLEMENT, in an article which is well worth reading.

From an American point of view the opposition to the Jews, which has lately been revived in Germany, seems to be due partly to a survival of the unchristian spirit of medieval Christianity, but more immediately to the hatred which thrift always inspires in the unthrifty. The military ardor which has converted Germany into a great camp has drafted the flower of German youth into army barracks, and diverted the best energy of the people from productive pursuits. At the same time it has impoverished the masses by direct heavy taxes to support the military establishment, and still heavier indirect taxes in cutting off the supply of productive labor. Though many Jewish youth in Germany have proved the native courage of the race on recent battlefields, the more peaceful instincts of the race have led them to seek in commerce and in the professions the distinction which the Christian youths of Germany have looked for in military and official positions. And now the cry is that the Jews monopolize the sources of wealth, and that they crowd the professions and other pursuits of peace and profit. The charge is doubtless largely true, but that fact is as much to the honor of the Jews as it is to the dishonor of those whose lower civilization has allowed them to be distanced in the competitions of peaceful industry, intelligence, persistence, and thrift. If the physically and numerically weaker race can distance their stronger and more numerous competitors in the arts of peace, the fact must be taken as evidence that mind counts for more than stature, and thrift and labor for more than military ardor, in the free conflicts of modern civilization.

DIAGONAL AVENUES IN CITIES.

The rectangular method of laying out cities leads not only to architectural monotony, but also to a great loss of time and travel as soon as the area covered becomes at all extensive. The tendency to go across lots, to save time and distance, is one condition of civilization; and when thousands of people are concerned the thwarting of the tendency is the reverse of profitable. A rectangular system of streets, with diagonal or radiating avenues, like those of Washington, is vastly more convenient.

In a paper read before the Philadelphia Engineers' Club, Professor Haupt, of the University of Pennsylvania, shows that the combined system is also vastly more economical. In a city like Philadelphia, where half a million people live at least a mile from the business center, the checker-board plan leads to an enormous waste of time and effort. To those whose homes lie in a direction diagonal to the run of the streets, the zigzag course they have to take increases their travel more than a third. A diagonal street through the heart of the city would save a mile and a third. The street car lines of the city carry something like 100,000,000 passengers a year. Upon this and the average yearly expense to the people of travel, Mr. Haupt calculated that every mile less in distance was a saving to them collectively of $1,500,000 in money, 4,000 years in time, and something like 3,300,000,000,000 foot pounds of energy.

Two diagonal avenues were recommended for Philadelphia, with "cut-offs" or diagonal lanes for pedestrians.

SUBAQUEOUS GOLD MINING.

A few days ago a schooner sailed from Bristol, R. I., laden with a small river steamer, a steam launch, and an outfit of mining machinery for working the auriferous bed of the Atrato River, South America. It is well known from the careful surveys made of the Atrato, in the interests of the proposed ship canal by that route, that the river sands in many places are rich in gold and platinum, and it is the purpose of the company which has sent out this expedition to work the river bed by a system of subaqueous hydraulic mining. In this way gold-bearing sand and gravel, at depths too great to be reached in the ordinary way, will be sucked up by steam machinery and the precious metal separated by washing. The machinery, devised by Mr. Samuel S. Webber, was built by the Herreshoffs at Bristol. The expedition appears to be well organized and capably officered. If it succeeds the venture is likely to be followed by similar assaults on other gold-bearing river beds whose wealth has been out of reach hitherto. The Atrato is the most westerly river which flows northward in South America. It drains a long reach of auriferous country and empties into the Gulf of Darien.

THE TECHNOLOGICAL, INDUSTRIAL, AND SANITARY MUSEUM OF NEW SOUTH WALES.

The World's Fair at Sydney has led to the establishment in that rising city of a museum devoted to technological, industrial, and sanitary matters. It is intended to contain typical collections of all materials of economic value, representing every stage of progress from the raw material to the manufactured product, with processes, machinery, and so on. Its scope includes every variety of animal products of use in the arts, vegetable products, waste products, and foods; specimens of useful and injurious insects and other representatives of economic entomology; economic geological specimens representing the products of mines, quarries, etc., in every stage of preparation and manufacture; educational apparatus and appliances; sanitary and hygienic appliances and systems; machinery and tools of every sort; models, drawings, and descriptions of patents, especially such as are likely to be of use in the colony; specimens of ethnology; ancient and modern industrial art work, with copies, photographs, etc.; exhibition catalogues, trade journals, price lists, and other vehicles of industrial information.

The project, if properly carried out, cannot fail to be of great educational and industrial value to the colony. It may furnish also an advantageous means of placing before the people of the colony specimens of tools, machinery, manufactured articles, or industrial processes likely to find a market there. The trustees of the Australian Museum, under whose direction this special museum is being formed, solicit contributions of trade journals, price lists, catalogues, and specimens of raw materials and manufactured articles likely to add to the interest of such a museum.

Our merchants and manufacturers who may be charitably inclined, or who may be seeking an extension of their trade with Australia, will find in this museum a convenient and comparatively inexpensive way of benefiting their Australian cousins, or of keeping their goods in a favorable position before the people they wish to trade with. No expense will be attached to donations, the trustees undertaking to pay freight and other charges on the arrival of the goods in Sydney.

The Erie Basin Dry Docks.

It is announced that the Erie Basin Dry Docks, which were recently purchased by the president of the Balance Dry Dock Company, are to be pushed to speedy completion. It is intended to make both docks at least 600 feet long, thus making them the largest establishments of their kind in America. The new dock at Baltimore is but 450 feet long, and Cramp's Dock at Philadelphia 462 feet. The Erie Basin Docks will be divided by a pontoon into two compartments of 300 feet each, either of them being large enough to admit the Pacific Mail steamers. The object of this is to really double the capacity of the docks. If a vessel of 600 feet is to be admitted, the pontoon will be raised, but if two vessels of 300 feet each wish to enter, the one that is to undergo the most extensive repairs will enter first, the pontoon will be closed, and then the other will be admitted. The inner compartments may be closed for an indefinite period during a long job, while the outer compartment may at the same time be opened and shut to a number of vessels. It is said that to complete the docks will require an expenditure of from $300,000 to $400,000. When finished the docks will accommodate, with one or two exceptions, the largest merchant vessels afloat.

The Lick Observatory Telescope.

The trustees of the Lick Observatory have finally closed the contract for the optical part of their great telescope. There has been considerable doubt whether a refractor or an enormous reflector would be selected, but the decision is in favor of the former. The object glass is to be three feet in diameter, and the Clarks of Cambridge, Mass., are to make it for $50,000. The mounting for the instrument is not yet provided for. Proposals will be obtained from the principal instrument makers of Europe and this country. Probably the mechanical part of the instrument will cost as much as the optical. It may be three years before the telescope is finished. If the instrument proves successful, it will be the most efficient ever pointed at the heavens. Its power will exceed that of the Pulkowa glass by forty-four per centum, and it will be almost twice as powerful as the great telescope at Washington, which at present is the best of its kind.

The First American Railway in Asia.

The first section of railway built by Americans in Asia was opened for traffic the first week in January, just twelve months from the date of the order for its construction. The completed division is twenty-three miles in length. The line is from Otarunai Harbor, on the west coast, via Lapparo, the capital of the Northern Island, Yezo, to the Paroni coal fields. It cost $20,000 per mile, which includes rolling stock, motive power, machinery for terminal repair shops, etc. The English line built between Tokio and Yokohama cost nearly $200,000 per mile, and it took five years to complete eighteen miles. The Japanese officials are said to be greatly encouraged by the prospect of an American system of rapid transportation.

Stones Clinging to Under Side of Ice.

When the severe cold weather came upon us so suddenly in November last my attention was called to a curious phenomenon in the Susquehanna River here. Upon Thanksgiving Day, not far below the dam which crosses the river here, I noticed a large number of stones clinging to the under side of the ice. The river there was two or three feet deep, the ice at that time about three inches thick. The stones were the rounded river stones, and evidently came from the bottom of the river. They were of all sizes, up to those weighing probably two pounds.

The phenomenon is not a new one, but it was displayed here upon so large a scale, and the conditions accorded so perfectly with those that the scientific explanation demands, that it seems to be worth while to call attention to it.

More than two hundred years ago Dr. Plot, of Oxford, England, described similar occurrences in the Thames, and gave at least a partial account of their true cause. It is well known that water, like most other substances, contracts under the influence of cold until it is reduced to a temperature of 39°. But if its temperature is lowered still further it *expands* until reaching 32°, when it freezes, by which its bulk is increased much more than by its cooling from 39° to 32°. Hence it is that water begins to freeze at the surface, since, when near the freezing point, the coldest water, being the lightest, is found upon the top, and it is that which freezes first.

But when the weather is very cold, and the different parts of the stream are thoroughly mixed by rapids or some such mechanical action, the water may be about the same temperature at all depths, and be lowered altogether nearly to the freezing point. In this case the water will *begin to freeze at the bottom*, because it is stiller there, and perhaps because the stones and bottom have lost some heat by free radiation and by contact cool the water. Although so much lighter than the water this ice would not rise as soon as formed, for it would be frozen fast to the bottom and the stones lying upon the bottom. But as soon as its size gave the cake of ice buoyant power enough it would tear itself loose from the bottom and the larger stones and rise to the surface, carrying with it the smaller stones and gravel. Then it would be frozen in with the surface ice, keeping its curious load frozen fast to its under surface.

In November the weather suddenly became very cold, the thermometer sank to 3°, and the river here was frozen over in one night, a very unusual occurrence. Moreover, the place where the phenomenon occurred was just below the dam, where the current was swift and the river rather shallow. All of these would tend to mix up thoroughly the whole mass of the water. These circumstances seem to show the above to be the true explanation.

In the Thames stones weighing as much as eight pounds have been known to be raised up from the bottom of the river in this way. Under favorable conditions, and acting through a long time, the ice by carrying these materials down streams must cause geological effects which are not inconsiderable.

G. M. PHILIPS.

Lewisburg, Pa.

The Expansion of Steam.

To the Editor of the Scientific American:

Page 321, last volume SCIENTIFIC AMERICAN, contains an article on "The Expansion of Steam," by Prof. Thurston, and page 360 one from William D. Marks, Dyn. Eng., etc., on the same subject. Quoting little from either, allow me to say that steam or any gas in expanding *does* trace a *strictly* mathematical curve of pressure. But it is *not* an "equilateral," or any other sort of hyperbola. The Boyle and Mariotte law, that the "pressure by the volume gives a constant product" is identical with one of the equations of the hyperbola ($xy = M$). But this law will only hold good upon the *impossible* condition that the temperature remains constant. In the equation of the hyperbola there are only two variables or factors—in the true curve there are three, corresponding respectively to the volume, the pressure, and the temperature of the expanding gas; and the equation of this curve *exactly* expresses the relation of the volume, pressure, and temperature of saturated steam or any gas, although each gas traces its own curve from the fact that the variable expressing temperature must be assigned a value corresponding to the specific heat of the gas considered. To find the pressure at any given point in the stroke of the engine after cutting off, let the practical engineer compare the volume (including clearance) at the given point with the volume at cut-off point, and from the tables in any book on modern steam engine he can find the corresponding pressure (always counting the atmospheric in addition to gauge pressure). An engine should expand the steam only so far as that the direct pressure on piston will exceed the back pressure to not only overcome the friction of the engine, but also the resistance of the driven machinery, and perform an appreciable amount of useful work besides. Prof. Thurston's formula is only claimed to be approximately true, while Mr. Marks is neither approximately, theoretically, nor practically correct.

B. F. MCKINLEY.

Lexington, Ky.

Professor Watson's Successor.

Prof. Edward L. Holden, of the Naval Observatory, Washington, has been appointed to the place in the directory of the Washburne Observatory at Madison, Wis., made vacant by the death of Prof. Watson.

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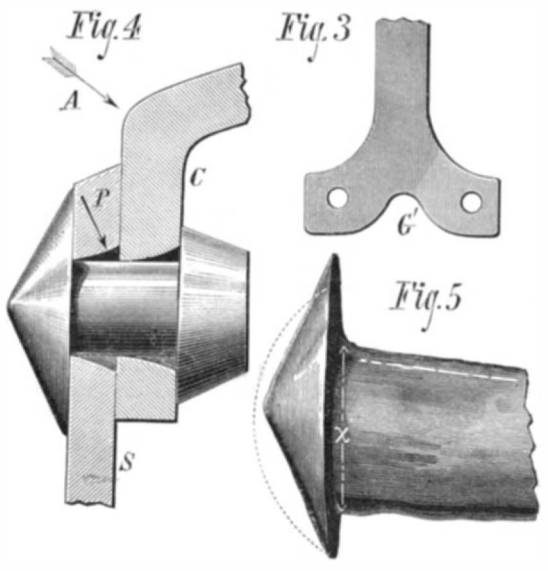
ANOTHER "MYSTERIOUS" BOILER EXPLOSION.

BY JOSHUA ROSE, M.E.

James McCreery & Co., whose well known dry-goods store is situated at the N.W. corner of Broadway and 11th street, in this city, have beneath the sidewalk in West 11th street a pair of cylindrical multitubular boilers, exactly alike, and by the same builder. They are used to heat the store and drive the elevators. On Saturday night, January 15, the engineer in charge banked the fires as usual and left them, returning on Sunday at 12:30 P. M. to see that all was right. He cleaned the fires, banked them again, and says he examined the dampers and saw that they were closed; examined the pressure gauges and found them to indicate 3 lb of steam; saw that there was plenty of water in the boiler, and left, leaving all so safe that, as he states, he would willingly have slept on top of the boiler. In all this he is corroborated by the fireman, who was present at the time. The watchman reports that he is positive the dampers were closed, because he noticed the presence of coal gas in the building, the smell being so offensive that he notified the burglar alarm office, at 4:30 P.M., that he was about to open the windows to let it out, which he then did. Shortly afterward, however, a terrific boiler explosion occurred, tearing away the massive girders overhead, blowing up the sidewalk above them, but fortunately, being Sunday, when that part of the city is deserted, nobody was hurt. The boiler was ten years old, and was tested in August last by hydrostatic test at 105 lb., and licensed for 70 lb It was usually worked at about 50 lb.

The daily papers have called this a "mysterious explosion," and so it is to the superficial observer, but close examination dispels the mystery.

On visiting the scene of the explosion I found that the crown sheet of the dome of one of the two boilers (which



RIVET, JOINT, AND BRACE-END.

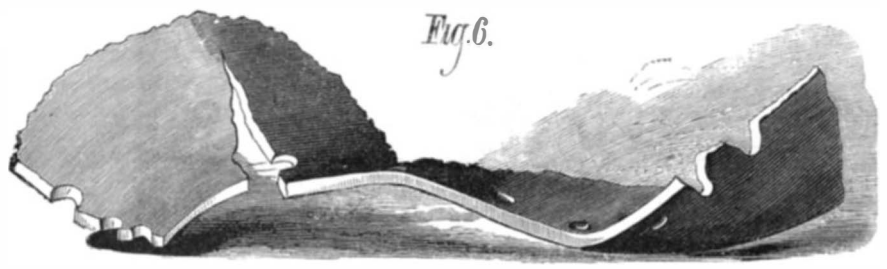
were connected by a steam pipe) had blown off completely, leaving a ragged fibrous edge right in the flanging bend, as shown at A, Fig. 2, which is taken from the dome on the uninjured boiler, and is a sectional side elevation. An inspection of one half of the exploded dome head, one half of which is at police headquarters and the other half (shown in Fig. 6) in the engine house, showed that the dome crown, in addition to tearing around the edge, at A, had torn across at B, being in two completely severed pieces. The iron at the fractures was in all cases of excellent and fibrous appearance. Two things, however, attracted attention: First, that the plate showed lamination in places varying from an inch to two inches in length, and running around the bend of the flange, at A. Second, the crack around A was too rusty to warrant the conclusion that it had been of recent formation. The greater part of this fracture was clean enough to admit of inspection, but some parts were not, and the dirt was so embedded in the fibers of the iron as to preclude its inspection. The edges of the two halves, however, appeared to have been fractured recently, probably at the time of the explosion.

The six stays, three of which are shown in place at C, Fig. 2 (drawn to a scale of one eleventh full size), were all in position in the dome, and it was observable that their surfaces having contact with the dome were covered where they fitted with a black polish, evidencing movement and some slight abrasion. These marks, however, did not, except in one case, extend all around the hole. During a visit to the boiler works the ring, A, of the crown sheet was bent and doubled, showing strength and ductility. I then chipped a piece along the edge, and the iron showed toughness and strength as far as such a test would determine, leaving no doubt in my mind, from all the appearances, that the iron was good.

During the inspection of the half crown sheet at police headquarters, I expressed to Inspector Horton the opinion that the crack around the edge, A, was decidedly not of recent origin, in which opinion he entirely concurred.

In considering what could have caused this fracture, the following points suggest themselves:

The stays, C, joined the cylinder of the dome 11 inches from the top (as marked in Fig. 2), and the crown sheet 7½ inches from the dome cylinder edge. Now, as the temperature of these stays increased they would expand and lengthen, exerting a pressure on the crown sheet in the direction of H. The steam pressure acting on the under surface of the crown sheet would also be in a direction to lift it; hence, as the pressure and temperature increased and decreased the crown sheet would lift and fall, bending it on A as a center of motion. The stays being at so great an angle would not be in a good position to resist this movement of the sheet; thus taking I as a center, the movement of the other end of C would be in the direction of F, while at D the direction of motion would be toward J, hence the direction of motion of the two would to a great extent coincide. That this view is accepted is proven by the fact that ten stays are now to be used instead of six, and that they are to be longer and more nearly in the line of strain, being as shown at G.



HALF OF THE CROWN OF THE DOME.

The old stays had a single rivet; the new ones have two rivets, the foot, G, one, being a crow foot, as in Fig. 3. The exploded dome shows an indentation at I, due to the motion of the foot of the stay, but this the two rivets will prevent.

If G′ be taken as a fulcrum the motion of the other end of that stay would be as denoted by E, offering a greater resistance to motion in the direction of K, and this increase of resistance would augment in proportion as the body of the stay stood more nearly vertical or more nearly in the line of the strain.

Now let it be noted that if a stay stands at an angle it will, under any increase of temperature above that at which it was riveted up, tend to push the two plates it connects apart (instead of holding them together) until the weakest plate has moved a certain amount. Thus, if the old stay, C, measures 15 inches, it will expand a certain amount per inch through a length of 15 inches; but the shell of the dome will expand through a distance of its vertical height from the hole at I, or in this case 11 inches only; hence to the amount that C would expand in 4 inches in length it would push against the crown sheet and help the steam to lift the crown sheet, and not until the crown sheet endeavored to move still further would C begin to act as a stay. The same effect will be produced in proportion as the line of the stay varies from a right angle to the surface it is to stay, hence the stays, C or G, should be as near vertical as possible.

Another error in the design of this boiler is that the diameter of the dome shell is 34 inches, and a circle of iron about 28 inches in diameter is punched out of the shell at D. This opening is required only to admit an inspector or workman to the interior of the boiler, hence it is several inches wider than it should be, which unnecessarily weakens the boiler. Yet another defect is that the shell of the dome has the wide side of the punched holes on the inside, as shown in Fig. 4, in which S represents a section of the shell and C of the crown sheet, the wide side of the hole being at P. As a result, the rivet has less hold upon the shell, and to whatever extent the rivet fills and binds against the walls of the shell it tends to force the two plates apart instead of binding them together. The extent to which the body of a rivet swells under even hand riveting is shown in Fig. 4, which is drawn from one of the only two rivets (that held the crown sheet to the shell) of the stays that have been found. The holes for these rivets were, as they should be, punched from the inside, and are therefore widest on the outside, the swell of the rivet at X showing how it expanded under the riveting blows and filled the hole. In this case the taper of the hole helps the rivet to bind the plates together. Here it is well to call attention to another fact, which is that in hand riveting pointed rivets are usually made, and these rivets do not present so strong a form of head as rivets riveted by machine, which have a button-head, as denoted by the dotted line in Fig. 5.

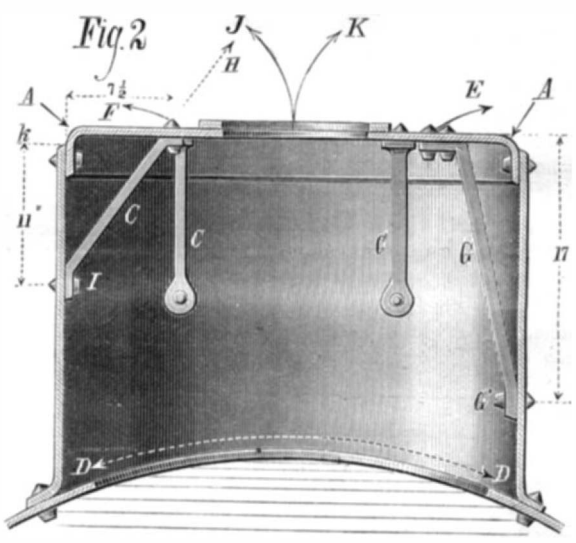
Now, while this explains why the crack at A, Fig. 1, was induced, and therefore one of the elements causing the explosion, it does not explain how it should happen that a boiler tested in August last at 105 pounds, and used daily during the week before the accident at pressures varying at from 40 to 50 pounds, should explode under a lesser pressure, or even under a pressure of 60 pounds, especially as it had a safety valve set to blow off at 60 pounds.

On questioning this part of the subject the engineer was questioned a second time, giving me the following information:

On his last visit previous to the explosion he "cleaned the dirt out of the fire and put fresh coal on, leaving the fire covering the bars," which was his usual method of banking, and the method practiced before he took charge.

He usually left from 3 to 5 lb. of steam after banking at night, and found from 20 to 25 lb. when he arrived in the morning.

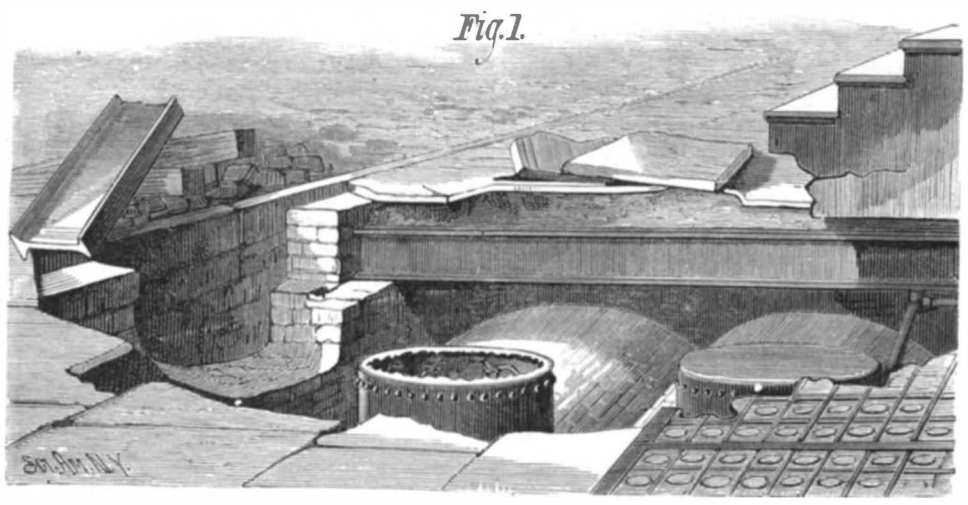
This method of *banking*, under which a steam pressure is slowly raised, is a decidedly dangerous one, because a little



VERTICAL SECTION OF DOME.

extra cleaning of the fire, the use of larger coal than usual, or leaving a rather better fire than usual, would simply cause a more rapid production of steam, whereas it appears that it was not uncommon to find the boiler in the morning with a pressure of within 15 lb. of that under which it was daily used.

The proper way to bank a fire is to pile it at one end of the grate bars, leaving nearly two-thirds of them bare, so that cold air would pass in freely if the fire burned up, and check any undue combustion, even if the dampers were left open. The practice of smothering a fire by leaving it spread over the bars and simply giving it a fresh covering of coal and closing the dampers, is a common and unsafe practice that ought to be prohibited. But one more point remains to be explained, which is; how did it happen that the test made in August did not develop the weakness of the crown sheet?



EXPLODED BOILER SHOWING THE UPHEAVED SIDEWALK AND BROKEN IRON GIRDERS.

The New York *Sun* credits Inspector Horton with saying as follows: "Possibly the expansion and contraction of the drum (shell) as the volume of steam was increased or diminished, had weakened the edges at the point of contact of the crown plate. This weakness, he stated, might not be developed by the hydrostatic test. Possibly the hydrostatic test might have weakened the iron to the point of breaking, leaving the first accumulation of high pressure to cause an explosion. But if the engineer's statement is true, the safety valve ought to have prevented an explosion, even if the fires were not banked and the steam ran up by the unexpected starting of the fires."

There has been for years a discussion carried on as to

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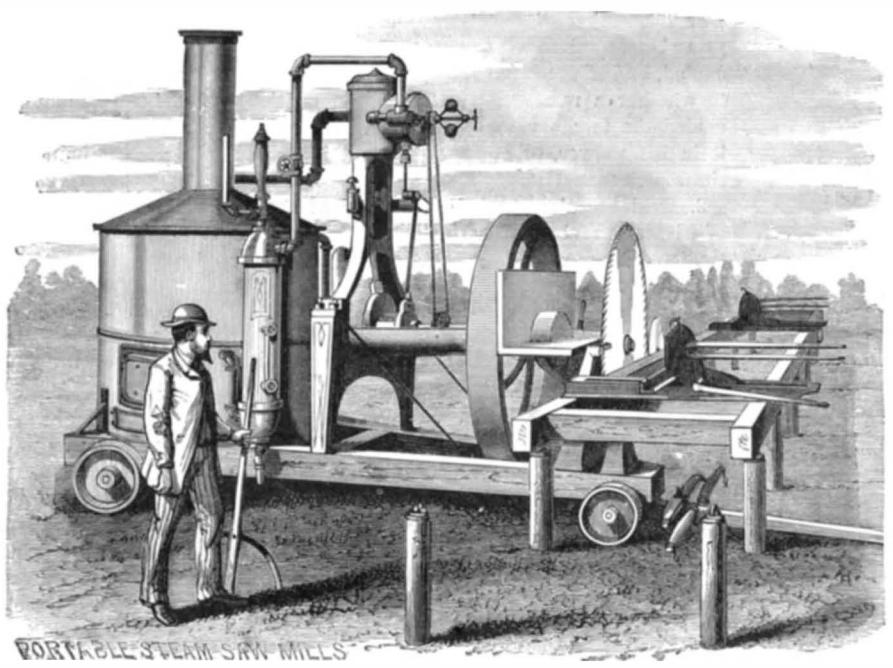
whether the hydrostatic test was sufficient alone, or whether the hammer test was not a necessary adjunct to the hydrostatic one, some indeed claiming that the hammer test alone is more reliable than the hydrostatic test. In this city the hydrostatic test alone is employed, and since so high an authority as Inspector Horton says that it may not discover an existing defect, but may induce a dangerous one, it is about time that it was supplemented with the hammer test. There is no doubt that the hammer test would have disclosed the defect in this boiler, and that Mr. Horton's views are entirely correct.

The writer endeavored to ascertain what amount of coal and refuse was found on the fire bars after the explosion, and how much was left on at 4:30 P.M. on Sunday, so as to see how much fuel consumption had taken place, but the bars had been cleaned.

Finally, as the safety valve was set to blow off at 60 lb., and the boiler was daily used at from 40 to 50 only, there is nothing to indicate that the boiler was, at the time of the explosion, capable of carrying, say, 55 lb., hence the explosion might occur when this pressure was reached without being relieved by the safety valve. This would leave the pressure to run up, under unusually favorable conditions, probably to but 30 lb. more than it sometimes was found at in the morning, which would easily be accomplished with no consumption or circulation of steam through the building taking place. The thoroughness of the crown sheet fracture is shown in the one-half of it presented in Fig. 6. The iron is what is termed three pile, that is to say, the mass from which it was originally made was composed of three thicknesses welded together, and it was defects in this welding, from the presence of dirt or other foreign material, which, when rolled out, formed these laminations. Now, in an unbent sheet the laminations would not form such serious defects, but in flanging or bending the edge, the laminations would tend to separate, and undoubtedly to some extent did so, weakening the plate at A, where the bend and the fracture took place.



PORTABLE STEAM SAW-MILL WITH HERRESHOFF BOILER AND ENGINE.

AMERICAN INDUSTRIES.—No. 65.

THE HERRESHOFF LAUNCH.

The remarkable little steam vessels turned out by the Herreshoff Manufacturing Company, of Bristol, R. I., have attracted world-wide attention, and in a very few years have earned a reputation which is truly enviable. These boats have not only been indorsed by the Bureau of Steam Engineering of the United States Navy, but their merits have been acknowledged by European engineers, and the English government has given its opinion in an emphatic way, by ordering a number of the boats to be used in the English navy.

The works of the Herreshoff Manufacturing Company were established in 1864, and consist of several machine and constructing shops, in which are employed about one hundred men. The works are on the shore of the Narragansett Bay, whose waters present a ready field for experiments in naval engineering, and afford facilities for developing, by actual trial, the best models for steam and sailing craft.

The Herreshoff Brothers possess, by inheritance, great talent for mechanical construction, especially as applied to marine engineering, and this talent has been developed by practical experiment supervised by these indefatigable inventors. From first to last success has followed their efforts, and, judging from the present showing, a prosperous future is before them.

During the first years of the operations of this company the business was chiefly confined to the construction of sailing craft of various descriptions, principally yachts and smaller pleasure boats, which were known all over the Atlantic coast for the fineness of their models, and their yachts became famous for their fast sailing, the beauty of their lines, and excellence of workmanship and material. Among the best known of the yachts built by the Herreshoff Company are the Clytie, Kelpie, Quivive, Sadie, Orion, Shadow, Triton, Faustine. These, together with a number of smaller yachts, are all noted for their speed, and have taken many prizes in our club and open regattas. About five years since the demand for steam launches and steam yachts sprang up, and this company, ever on the alert to meet the wants of the people, turned its attention to perfecting and constructing this class of vessel. In this their success has been remarkable, and to-day they turn out the fastest, safest, and handsomest vessels that ply either in our own waters or those of any other country. The distinguishing feature of the Herreshoff system of marine steam machinery, is the safety coil boiler, which has been brought to great perfection and patented by the Herreshoff Brothers, and which is shown in two forms in our first page illustration. The boiler consists of a spiral coil made of iron tube arranged with proper spaces between the coils for the escape of the products of combustion. The coil is made of conical form and surrounds the combustion chamber, presenting an effective heating surface to the fire. The heated gases proceeding from this chamber are made to pass through the spaces of a flat coil at the top, which heats the feed water before its entrance to the boiler proper. The feed water is forced in at the cooler end of the flat coil, through which it passes to the top of the main coil, and descending, is finally discharged into a vertical cylinder, which is called the separator, and in which the steam and water discharged from the coil are divided, the water falling to the bottom, the steam being taken from the top and passed through a superheating coil located above the main coil, which completely dries and superheats the steam. Generally a single coil is used as the steam generator; but when the greatest economy is the main consideration, a double coil, in which one is placed within the other, is employed. Both forms of boiler are shown in the engraving.

The advantages possessed by the coil over the shell boiler in any of its forms are marked and are apparent almost at first sight. The coil is absolutely safe from destructive explosion, and weighs less than one-half as much as other boilers of the same capacity, and in point of economy its superiority is undoubted. It is capable of raising steam from cold water in from five to seven minutes. This is an important feature, especially in steam launches and torpedo boats, where time is an all-important matter.

The engines used in the Herreshoff system for marine purposes are of the compound condensing type, having feed and air pumps attached. The machinery of this system is especially noteworthy for its extreme lightness and for the judicious distribution of material, all of the parts having ample strength, and no portion being loaded with useless metal, which would rather detract than add to the efficiency of the machine. These engines use the steam with the highest economy, actual and prolonged tests having proved the efficiency to be at least 40 per cent greater than that of the non-expanding type. As to mechanical details of construction, finish, proportion, and general design these engines leave nothing to be desired.

Of the several steamers shown in our engraving, the one hundred foot size—of which a number have been built—is considered by yacht men as the most advantageous size for coastwise cruising. It can be handled by a few men, consumes a minimum of fuel, and, what is more important than anything else, the interest on first cost is small in comparison with that of the large iron steamers recently added to our fleet of pleasure vessels. The plan view in the front page engraving shows the arrangement of the interior of one of these yachts so accurately that no further description is required.

The maximum speed of the 100-foot yacht is 18 miles per hour, and in that time it burns only 200 pounds of coal. Three men manage the vessel easily. The 60-foot yachts are planned with a view to river, bay, or lake navigation, and are arranged to accommodate a number of persons for short excursions. Yachts of this size will steam 15 miles an hour, and in that time will consume about 90 pounds of coal.

The Herreshoff torpedo boats have features peculiar to themselves, which distinguish them from everything else of the same class, and have earned for them a well deserved reputation. They are at least three tons lighter than those of foreign make; they will go astern as fast as ahead, and can stop in half their length from full speed. They are capable of turning in a circle whose diameter is three times the length of the boat. All these desirable qualities are due to the lightness of the entire structure, including the boiler and machinery, and to the position of the screw, it being located under the hull at about one-third of the distance from the stern to the bow. The quickness with which steam can be raised is of inestimable strategic importance in naval warfare, as it admits of repelling sudden attacks of an enemy, the boat being always ready and capable of being put under full steam by the time its keel touches the water. These boats are fitted for the use of either spar or Whitehead torpedoes, and are supplied with four spars, two at each end, when the spar torpedoes are employed. By this means the efficiency of the boat is immensely increased, their remarkable quality of backing as readily as going ahead rendering the use of stern spars perfectly practicable.

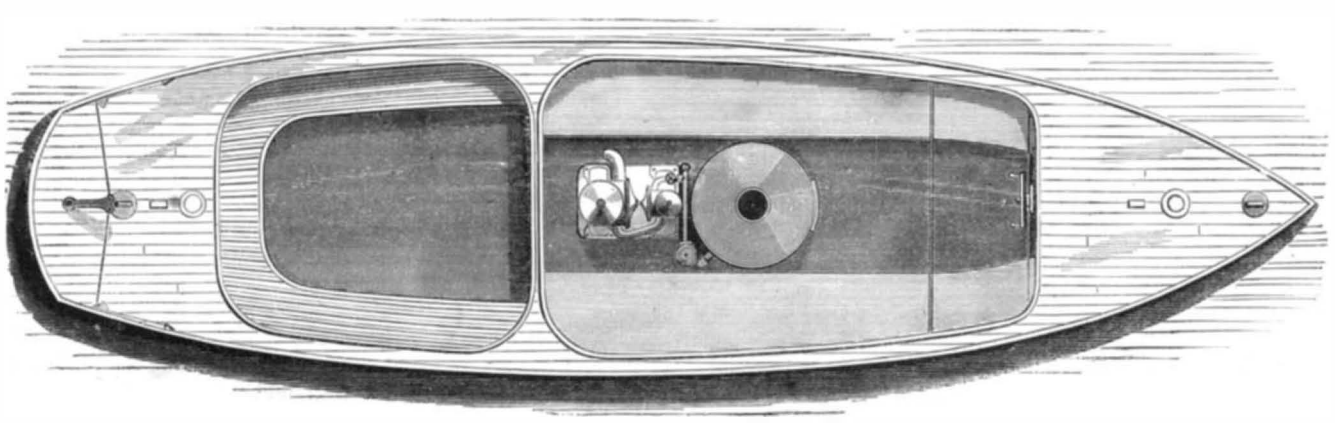
The length of the torpedo boat is 60 feet; width, 7 feet; depth, 5 feet 6 inches. Their weight when ready for service is 6 tons, and they are capable of steaming 23 miles an hour, developing 150 horse power.

In the whole range of the manufactures of this company, perhaps the most successful craft is the navy or government launch, shown in the engraving. It is 33 feet in length, 8 feet 6 inches in width, and is furnished with a folding tent or awning over the standing room, either or both sides of which may be raised to protect passengers from rain, spray, or wind. When not in use the tent folds down snugly on either side of the boat outside the rising. Either or both sides of the tent may be elevated, thus making an awning proper.

The general advantages of the Herreshoff launch are summed up in the preliminary report of Chief-Engineers Isherwood, Zeller, and Carpenter, from which we make the following extracts:

"The following general opinions, arrived at by close observation during long and exhaustive experiments, can be depended on.

"1. As regards the hulls of the launches. The models of the Herreshoff launches and the distribution of their weights have been so perfected by long and intelligent experience and experimenting, as to scarcely leave room for improvement, the Herreshoff Manufacturing Company having for many years made a specialty of designing, constructing, and testing steam launches, steam yachts, steam torpedo boats, and similar vessels. The material is of the best quality, well seasoned, and carefully selected. It is so distributed in the construction of the hulls that the required strength is obtained, with the least weight; the thoroughness and perfection of the fastenings being depended on, instead of masses of material poorly secured. The workmanship cannot be excelled in neatness, finish, and skill. These hulls combine the maximum of strength with the minimum of weight, which is the end to be attained in this class of vessels where lightness is of the first consequence for stowage on board ship, carrying capability, small draught of water, and speed. In all these particulars of model, construction, combination, strength, finish, lightness, quality of materials and workmanship, the Herreshoff steam launches are incomparably superior to the navy launches, a superiority resulting from the fact that the latter are only occasionally designed and built at the navy yards, and then by persons whose skill and experience lies in the designing and constructing of large vessels, and who devote little or no attention to what is considered as comparatively a small matter, but which, if the highest excellence is to be attained, requires much special training and experience.



PLAN OF 33-FOOT LAUNCH.

"2. As regards the machinery. The system of machinery employed in the Herreshoff launches is quite original in most of its details. It is diametrically opposite to that which is used in the navy launches and is in every particular greatly superior to the latter. In the navy launches a single cylinder is employed, and the starting and stopping are consequently uncertain and slow, with the risk of damage and accident from running into wharves and vessels, and also loss of time.

"In the navy launches steam of high pressure (80 to 100 lb. per square inch above the atmosphere) is used almost without expansion, and it is generated in a type of boiler whose strength is only moderately in excess of the pressure. This steam is not condensed, but is exhausted direct into the chimney of the boiler to cause sufficient draught for generating the disproportionately large quantity of steam required with this system.

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"In the Herreshoff launches the engines are by preference of the compound type and of the simplest design; the two cylinders are connected at right angles, and the control of the vessel is thus made complete, there being no time lost and no uncertainty in the starting, stopping, and backing. There are no independent cut-off valves, the difference in the areas of the pistons of the two cylinders giving, without that complication, an expansion of from four to five times, so that all the economy possible from this source is attained. The boiler is practically inexplodible, being composed of a coil of iron pipe from two to three inches in outside diameter according to size of boiler. The steam pressure carried, however, is comparatively low, ranging for ordinary use from 40 to 60 lb. per square inch above the atmosphere; the engines being made strong enough to run under a pressure of 150 lb., or as much as the boiler can be made to furnish. This boiler has a forced circulation, is absolutely safe both on account of its strength and of the very small quantities of steam and water which it contains; it is operated by natural draught, which, however, can be increased by a small steam jet thrown into the chimney whenever there may be a demand for the maximum quantity of steam. The economic vaporization is as good as that of any other marine boiler. This boiler, owing to its forced circulation, with the feed water entering at the top of the coil while the steam is drawn off at the bottom, can be successfully employed with the highest rate of combustion given by a powerful fan blast delivering the air into a closed ashpit; that is to say, with a combustion of 50 lb. of coal and over per square foot of grate surface per hour; being in this respect the only boiler composed exclusively of tubes that can be worked at exceptionally high rates of combustion. In all other boilers of this kind the rate of combustion is limited by the fact that as soon as the quantity of heat thrown in a given time on the tubes reaches a very moderate amount, the water is driven from the iron, which, deprived of that protection, speedily burns out.

"The coil boiler is the lightest ever constructed for its power, and the weight of water contained in it is the least. This boiler is the peculiar feature of the Herreshoff system and the only part patented.

"The engine is condensing, the steam from the cylinder being exhausted into a surface condenser of the simplest design and lightest execution, formed by a copper pipe secured to the outside of the hull just above the keel. By this means the boiler is supplied with fresh water, and the slight quantity lost by leakage is restored from a small tank situated beneath the boiler.

"The continuous service of the launch is thus limited by only the weight of coal it can carry, and not by the weight of water it can carry. The bunkers can easily and quickly be refilled from other vessels at any locality, but the filling of tanks with fresh water can only be done where fresh water can be obtained.

"The use of condensing engines with surface condensers renders the Herreshoff steam launch of real military value, from the length of time it can continuously steam, and from its freedom from noise. When the engines are stopped temporarily, the steam is then blown from the boiler directly into the condenser and there condensed, the condenser, under the circumstances, cannot be overheated, as the outboard pipe is in continual contact with continuously changing outside water even when the vessel is at rest.

"The navy launch carries 960 pounds of coal in the bunkers, and 2,500 pounds of water in the tanks, and in smooth water can maintain a speed of 7 statute miles for four consecutive hours, after which the tanks must be refilled.

"The Herreshoff launch carries 1,120 pounds of coal in the bunkers, and can maintain a speed of 7 statute miles for twenty-eight consecutive hours, after which the bunkers must be refilled. But if there be added to the fuel weight the 2,500 pounds in water in the navy launch, then the consecutive steaming of the Herreshoff launch can be extended to ninety-eight hours.

"The maximum speed of the navy launch was 8·5 statute miles per hour, and of the Herreshoff launch 11 statute miles per hour.

"When the two launches were tried together in very rough water, against a strong head wind and sea, the superiority of the Herreshoff launch was much more marked than in smooth water. While the navy launch took in so much water over the bows as to endanger her safety, and to require constant bailing with buckets, the Herreshoff launch was dry. She was much better trimmed, lighter, more buoyant, and every way superior in nautical qualities to the navy launch, at the same time making double the speed.

"As regards economy of fuel, the Herreshoff launch develops the indicated horse power with less than half the coal required in the navy launch. In every particular the superiority of the Herreshoff launches to the navy launch was so marked as to be apparent to the most cursory observation. Their weight was one-half and their economy of fuel was double; their nautical qualities were much finer, their carrying capacity was greater, their finish and general arrangement were better, they were noiseless, and their capability of continuous service was enormously greater. The superior adaptability of the Herreshoff system to that of any other known to us, for steam launches, steam yachts, steam pinnaces, torpedo boats, small gun boats, etc., is so unquestionable, that after the most extensive experiments and thorough examination of the subject, we are constrained to recommend it, though comparatively new, to the serious attention of the department for such classes of vessels. The management of the boiler differs from the management of boilers of other types, but is soon acquired by the humblest intelligence, and we believe the engineering of the Navy should be familiarized with it as speedily as possible, as its use is certain to extend as its merit becomes understood."

In addition to marine work the Herreshoff company are at present giving particular attention to engines for electric light. The quickness with which steam may be raised, the freedom from danger of explosion, the lightness of both boiler and engine, and the perfection of the mechanical details, render this system valuable for this purpose, and admits of placing powerful machines in the midst of crowded cities without danger to life or property.

This system has also been successfully employed in working bridge draws, dummy engines, portable and stationary pumping engines. For saw mills it has peculiar advantages. Its safety, portability, and its quick and powerful steaming qualities, give it the precedence over other steam motors.

The entire range of the manufactures of the Herreshoff company exhibit careful and intelligent supervision, and workmanship that is in every way superior.

Manufacturing in New York City.

Of late years Philadelphia has justly boasted of being not only the largest manufacturing center in the United States, but the largest in the world. If the chief special agent for the collection of manufacturing statistics for New York, Mr. Charles E. Hill, is correctly reported, our city now takes the first place in productive industry as well as in commerce and population. Mr. Hill estimates that the final footings will show the value of our manufactured products to be fully $400,000,000, or nearly $77,000,000 more than Philadelphia's product. This excludes the numerous factories situated in what are practically suburbs of the city, and operated by New York capital and brains.

DECISIONS RELATING TO PATENTS.

United States Circuit Court—Northern District of Illinois.

BARBED WIRE FENCES.—WASHBURN & MOEN MANUFACTURING COMPANY *et al. vs.* HAISH. WASHBURN & MOEN MANUFACTURING COMPANY *vs.* SAME.

Drummond and Blodgett, Judges:

1. An assignment purporting to convey all the right, title, and interest in letters patent "excepting thirty two or thirty three counties, heretofore sold and assigned," without designating the counties thus previously sold, is not so far ambiguous as that nothing passes thereby, the reservation being such as is capable of being made certain by competent evidence, showing what counties have been actually conveyed.

2. The action of the Patent Office in reissuing a patent to assignees raises a presumption of title in the assignees named, and if the defendant wished to raise the question as to whether a reservation contained in an assignment included the territory in controversy, he should have raised it in his answer, or at least have put in proof tending to show such fact.

3. Evidence almost wholly made up of the recollections of witnesses revived after the lapse of many years, and contradicted in most instances by explicit testimony of other equally credible witnesses, leaves so much doubt as to the actual existence of the device as to make it unsafe to defeat a patent on the ground of public use thus sought to be established.

4. Evidence of the state of the art showing the prior existence of analogous devices for substantially the same purpose, but not fully exhibiting the device patented, operates to narrow the field for the exercise of inventive faculty and limit the range of the patents.

5. A device, in order to be patentable, must be the result of invention, but the mere mechanical adaptation of old things to new uses is not usually invention, unless in combination.

6. Invention appearing, the law does not attempt to measure its extent or degree.

7. Utility is suggestive of originality, and the fact of the acceptance of a device or combination by the public and putting it into extensive use, is accepted as evidence that it was the product of invention.

8. An inventor may, in his reissue specification, make his description more full and accurate; but he must not substantially change it so as to describe another device or cover anything not in the original.

9. The original patent was for "the method of providing the wires of a wire fence with a series of spur wheels," and a reissue was obtained for a "fence wire provided with spurs for the purpose specified;" *Held*, not to be a departure from the original invention, the only changes in the specification serving merely to give point or direction to the invention claimed.

10. Matter so described in the original specification that it might have been claimed in the original patent, may properly be claimed in the reissue.

NEW INVENTIONS.

Mr. Rush E. Avery, of New York city, has patented a folding cot which can be folded or erected without attaching or detaching or coupling any of its parts. It is very convenient for transportation, occupying only a very small space when folded.

A safety attachment for watches has been patented by Mr. James Roberts, of Brooklyn, N. Y. A plate or ring, having scalloped edges, is slipped over the stem of the watch, projecting horizontally, and so nearly filling the pocket that when a thief attempts to extract the watch the projecting plate will catch in the lining of the pocket and alarm the owner. Or, if the thief attempts to take hold of the plate itself, the pressure of his fingers in the narrow space between the plate and the pocket will alarm the owner.

Mr. William Hoffmeister, of Mossy Creek, Tenn., has patented a double try-square. Two ordinary try-squares are joined together side by side, a suitable and adjustable distance apart, by a metal plate and screws or equivalent means, by which means the square may be made to straddle boards of different thicknesses. The scope of the tool is by this means much increased, and kinds of work performed with it which are not possible with the ordinary try-square.

Mr. Wilhelm Espig, of Berlin, Germany, has patented a billiard table, which provides means for adjusting the bed to different heights from the floor, and also for extending its frame for the reception of table boards whereby it may be converted into an ordinary dining table.

Mr. Francis Hopkins, of New York city, has patented an improvement in eyeglasses, the object of which is to obtain a firmer gripe upon the nose without tightening the spring, to prevent the glasses from slipping forward on the nose, and to hold them on the nose nearer to and on the same plane with the eyes. This is accomplished by forward projecting arms to which the spring is attached.

Mr. William H. Older, of Packwaukee, Wis., has patented an improved construction of buildings designed especially for barns upon prairies and other parts of the country where timber is scarce. A peculiarly constructed frame of timber and wire, the timbers being secured by bolts, is the principal feature of the invention. The outside may be covered with straw thatch, tarred paper, etc. A serviceable building can thus be constructed with little timber and at a small cost.

In a thill coupling patented by Mr. Levi B. Stuart, of Seymour, Conn., a grooved cushion and centrally grooved plate are claimed to provide a more durable and more easily adjustable spring to prevent rattling of shafts on their bolts than has hitherto been supplied.

A log tripper patented by Mr. Levi Gunter, of Gunther's Mills, S. C., consists of a novel arrangement of levers and an improved hook, whereby a saving in power and labor for turning logs in saw mills is effected.

Mr. Samuel White, of Eau Claire, Wis., has patented an improved head block for sawmills which comprises improvements in the jacks or standards of the head blocks, the dogs for holding the logs upon the carriage, and the means for receding the jacks upon the head blocks.

Mr. Charles P. Batt, of Phœnixville, Pa., has patented a pendulum scale which consists in a novel combination and arrangement with each other of a pair of weighted levers, a pair of connecting bars, and a vertically operating scale-beam and indicator.

Mr. Edwin B. Hutchinson, of Detroit, Mich., has patented an improved account-book, which saves time and work in making up trial-balances from a ledger. The book is bound with half leaves that are ruled for an index, and fitted with a removable pad provided with leaves ruled in columns for account totals, arranged for two or more balances, which pad when in place forms, with the bound half leaves, a complete trial-balance book, into which the headings or names can be copied on the bound portion and the accounts carried out upon the pad leaves for two or more balances, and the pad renewed by another when exhausted, all with but one entry of the names or headings.

Mr. Ura H. Palmer, of Elizaville, Ky., has patented a wheat heater for flour mills, in which the grain is heated by the direct contact of hot air, the air being heated by a lamp and circulated in currents through perforated tubes, among which the grain passes by virtue of its own gravity.

Mr. Prosper Humbert, of Austin, Texas, has patented a three-wheeled vehicle which has one or more seats so arranged that the forward seat turns with the horses so that the driver is always directly in the rear of the horses, and holds the reins at the same length no matter how much the horses may turn to either side.

Mr. George B. Taylor, of New Brunswick, N. J., has patented a feed-water heater for steam engine boilers and locomotives. The heating chamber is formed of two plates attached to a frame, and its interior is divided into zigzag form by strips extending alternately from the top to the bottom, and from the bottom to the top. The heating is accomplished by the products of combustion as they pass through the smoke box.

Mr. Charles Niederauer, of La Grange, Texas, has patented a cultivator in which the standards may be adjusted to regulate the depth of the cultivators or plows to avoid obstructions. Each cultivator or plow standard has attached to it an adjustable segment, and the standards are all operated together by a lever and link connections. The plows are thus raised, while the main frame upon which the operator rides is not raised.

Mr. Gottlieb Kinsey, of Lock Seventeen, Ohio, has patented an attachment for reapers and mowers which is a substitute for ordinary reel, and which, while less expensive, is claimed to be equally as effective. It consists substantially in a rake which is automatically raised, swung forward, lowered, and drawn back as the machine advances to draw the grain or grass against the cutter bar.

Mr. Jacob Gilstrap, of La Plata, Mo., has patented a wind wheel of that class in which the access of wind is controlled by hinged valves regulated by the action of a governor. Instead of two cords and rings for connecting each valve to the governor Mr. Gilstrap uses only one cord to operate the valve in one direction, its movement in the other direction being controlled by a spring. By this means the number of parts is greatly lessened and a consequent reduction in friction results.

Mr. John Coyle, of East New York, N. Y., has patented a combined lampwick-trimmer and burner and chimney cleaner constructed of a brush, a square staple, and a serrated disk, whereby the charred portion of the wick can be removed, the wick and burner brushed off, and the inner surface of a lamp chimney cleaned.

Mr. William Jones, of Nashville, Tenn., has patented a machine for making rim tops of vessels. It operates upon a straight strip of metal, flanged at one edge, to convert it into a hoop of the desired dimensions and of such shape in cross-section as renders it peculiarly suited to form the flange for the cover of sheet metal vessels.

Mr. Bolivar J. Quattlebaum, of Williston, S. C., has patented a portable dental engine which may readily be set up in small compass and readily taken down and packed in small compass for transportation. The frame of the machine can be adjusted to form a case for the working parts when packed.

Separation of Cobalt and Nickel.

Reichel gives the following new method for the qualitative separation of these two troublesome metals, especially when there is but little cobalt in the presence of a larger quantity of nickel. Both metals are precipitated with potassic hydrate solution and filtered. The unwashed precipitate is thrown into a test tube and heated with very strong pot ash until it boils. Under these circumstances the cobalt dissolves with a *blue* color, thus proving its presence in a very simple manner. Z. A. C.

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Scarlet for Felts.

The following two processes give shades which bear soaping. The dyeing is done in a well-tinned pan or a wooden cistern the goods are entered, at 115° Fah., in water, to which 1½ lb. white argol is added, and boiled strongly for a long time, turning occasionally. Lift, and add the dissolved coloring matter; re-enter, turn, and add gradually, lifting the goods before each addition of 11 lb. tin composition. The beck is then brought to a boil again, which is kept up for half an hour. Lift, cool, and wash well.

If the argol does not loosen the tissue sufficiently, it is recommended to add a small quantity acetate of soda.

The tin composition is prepared as follows: Muriatic acid, 3 lb., nitric acid, 1 lb.; water, 1 lb.

To every 6 lb. of this mixture 1 lb. of granulated tin is added, with the aid a gentle heat.

Sulphuric acid may be used instead of the tin spirits, but the shades are less pure.

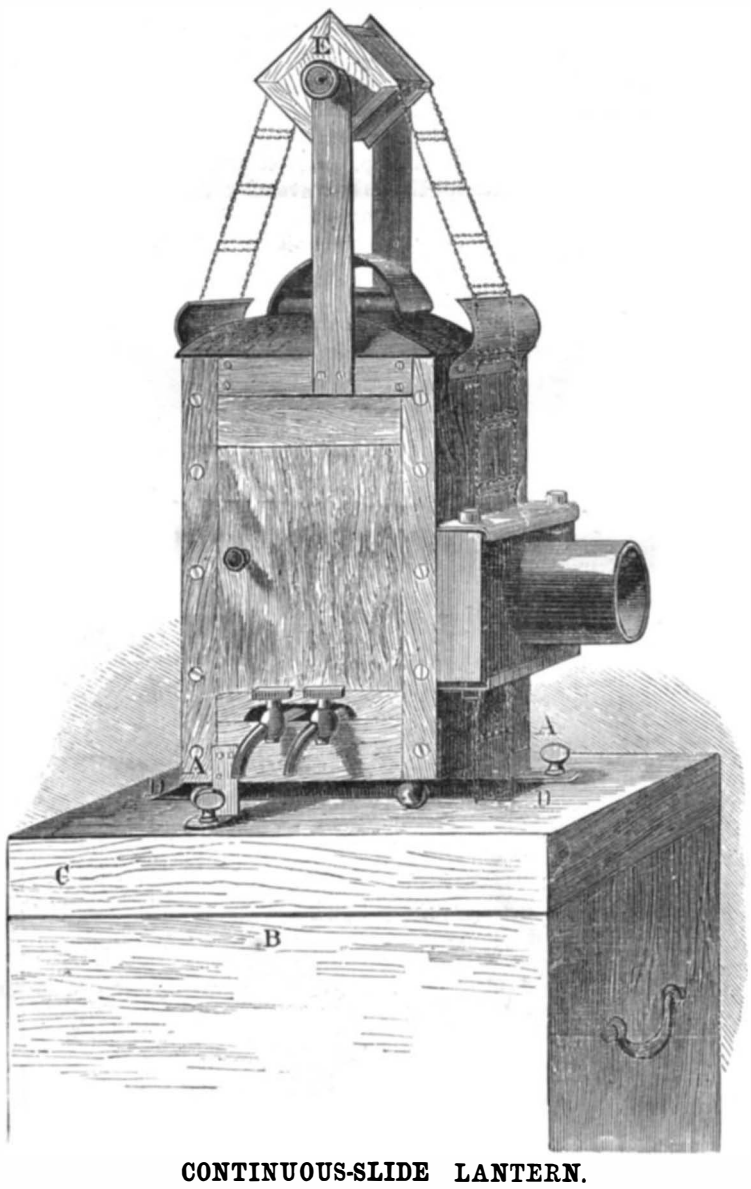
The first method consists in dyeing the goods thus mordanted with the "Ponceau 2 R" of the Aniline Color Company of Berlin. In the second the goods mordanted in the same way are dyed with "Ponceau S extra," made by the same company.—*Muster Zeitung für Faerberei.*

CONTINUOUS-SLIDE LANTERN.

The engraving shows a lantern which possesses certain advantages, and is specially adapted for lectures where the subjects follow each other in an unbroken series. Mistakes arising from the insertion of a wrong slide, or an inverted subject, are apt to mar an evening's entertainment. But, as will be seen, errors of this nature are altogether avoided, and by a simple mechanical arrangement, the slides present themselves in perfect order and at their allotted times.

The instrument is fixed to the top of the packing case, B, by the screws, A A; the lid of the case, C, serves to elevate or depress the lantern which may be fixed in position at any angle. Reared above the chimney are two metal uprights, secured to the sides of the lantern. These carry at their apex a wooden cube covered with fine leather; each side of this cube corresponds with the size of the slides. But, by the aid of strong ribbon binding, the slides are so united as to form a flexible band which traverses the cube and descends into the case, B, through slots, D D. The cube turns on its axis, E, to which is attached a milled head. The band is made so that the slides can be detached and replaced by a new series at will.

The advantages of this simple arrangement are so obvious as hardly to require further comment. The operator has only to turn the milled head of the cube in order to bring his subjects, one after the other, into position. This system might be applied also to the dissolving view apparatus. The heat from the chimney is never so intense as to interfere in any way with the slides, while it clears them of surface moisture, by which they might be obscured during cold weather.



CONTINUOUS-SLIDE LANTERN.

An Aluminum Battery.

A curious and novel voltaic cell has been devised by Herr Wöhler, and described in *Liebig's Annalen*. The chief peculiarity is that both plates are of the same metal—aluminum—and a tolerably strong current is supplied. The cell consists of a glass vessel six inches high, filled with very dilute hydrochloric acid, or caustic soda, and containing an inner porous pot filled with concentrated nitric acid. In each compartment is placed a cylinder of aluminum provided with a projecting lug which passes through the cover of the vessel, and acts as a contact piece for the electrodes or conducting wires. As soon as the aluminum cylinders are plunged into the acids, a current is given off sufficiently powerful to heat a platinum wire red hot.

To Make Chloride of Gold and Nitrate of Silver.*

Procure 8 grammes = 5 dwts. of fine gold, and after rolling out to thin plate, cut into small strips. Get an olive oil flask, and clean it well with a warm and saturated solution of soda and water Fill the flask half full of water, and set on a sand bath over a heat that will slowly bring the water to boiling, which will both temper and test the flask; if it stands this test it is fit to be used. Put the pieces of gold into the flask, then mix in a small bottle half an ounce of pure nitric and two ounces of muriatic acid, and pour some of this into the flask to cover the pieces of gold, place it in a sand bath over a gentle heat, and put over the mouth of the flask a small piece of glass to prevent the solution from spirting out while in action. As soon as the acid ceases to act on the gold, and if any remains undissolved, add more of the mixed acid, and continue to add little at the time as often as it stops acting on the gold until all is dissolved; remove then the flask from the sand bath and let it cool, then add to it about its like quantity of water, and boil over a heated sand bath until about half of it is evaporated; remove and pour the solution into a glass or porcelain dish, and rinse the flask several times with small quantities of warm water, which add to the solution.

Now prepare a filter in a small glass funnel, place it in the flask, and filter the solution back, and before the filtering is nearly completed pour a few drops of water at a time into the filter in order to wash the gold out of it, and until the solution is increased to about a third in bulk, then return it to the sand bath and evaporate again to about half; after this pour the solution into an evaporating dish and rinse the flask with warm water and add the rinsing to the contents in the evaporating dish, then add about 1 gr. 50 centigr. of fine table salt for each gramme or 1½ dwt. for each dwt. of gold dissolved; place it on the sand bath, stir it well with a glass rod until perfectly dry, then allow it to cool, when it will be ready for use, or to be poured into small bottles for sale. The 8 gramme or 5 dwt. of gold used will realize 24 bottles containing 1 gramme or 15 grains of chloride of gold to each bottle and will pay well for the trouble of preparation. The chloride of gold prepared in this manner will answer for making solutions for electro-gilding or for photographic purposes.

To make nitrate of silver, take granulated fine silver and put into a glass flask similar as used for dissolving gold, pour pure nitric acid mixed with about half the quantity of warm water into the flask to cover well the silver, place the flask in a sand bath over a gentle heat or into a vessel of hot water, which must be kept hot by placing over a spirit lamp until the acid ceases acting on the silver; if silver remains undissolved in the flask, remove it from the sand and let it cool; then pour off the liquid into a porcelain dish, add a little more acid to the remaining silver in the flask, and place it again over heat until dissolution of silver ceases, and keep on repeating the decanting and adding until all the silver is dissolved. By this method an excess of acid is avoided. After the solution has cooled add to it about half its quantity of water and filter it through asbestos broken up and placed in the filter in the neck of the funnel; after filtering pour into an evaporating dish and place it on a heated sand bath and evaporate until you perceive a light scum on the surface of the liquid, when it is removed and allowed to cool, and when nearly cold is placed on ice covered over and left undisturbed for twenty four hours, when crystals of nitrate of silver will form; the crystals are removed with a pair of platinum pincers into a glass funnel placed into the neck of a bottle, and as soon as the crystals have given over dripping pour quickly about an ounce of water over the crystals, and after done dripping repeat it twice more; take the crystals out of the funnel and spread them out on a china plate and place on a warm stove to dry. Pour then the washings of the crystals back to the remaining silver solution not yet crystallized, evaporate and filter the same as before and set by to crystallize, and repeat the process until nearly all the silver is disposed of. The small remainder of silver solution may be decomposed into chloride of silver by adding gradually small quantities of salt water.

In order to obtain crystals of large size, the moment of forming the scum on the solution has to be watched during evaporation and advantage taken of by removing it from the sand bath at this point. Another advantage of greatly accelerating the formation of crystals is to put a piece of nitrate of silver into the solution before placing it on the ice. This method will produce nitrate of silver of a better and purer quality than generally bought of dealers.

*From the *Deutsche Chemiker Zeitung*, by H. Bush, Hull.

MISCELLANEOUS INVENTIONS.

An improved end gate for wagon bodies, patented by Mr. Thomas Dwyer, of Kendall, Ill., supplies drop end gates which may be turned down and supported in horizontal positions to serve as platforms for convenience in shoveling oats out of wagons. It may also be turned down in a vertical position out of the way. Quadrantal wings with stop devices enable these adjustments to be easily made, and hold the gate securely when adjusted.

Mr. George T. Hedrick, of Weaverton, Ky., has patented a nozzle and stopper for grain bags. It is metallic, and the bag is gathered and attached to it by a draw string. The stopper is a metallic disk with a spring catch which engages interrupted flanges on the interior of the nozzle.

A lock and latch combined, patented by Mr. Charles F. Batt, of Phœnixville, Pa., is so constructed that the lock cannot be readily picked, and both the bolt and the latch can be operated by the same key. It also allows the latch to be thrown out of or into gear with the spindle.

Mr. Earnest J. Krause, of Carlisle, Pa., has patented a fire escape ladder, which provides means for adapting the hooks of a fire escape ladder to window sills of all widths, and for holding the ladder as firmly on narrow sills as on broad ones.

Mr. Orlando H. Jadwin, of Brooklyn, N. Y., has patented an improved cable traction for street cars. A peculiar clutch attached to the car serves, at the will of the conductor, to attach the car to the traveling cable, which runs in a channel or trough formed in the ground. Devices are also supplied to hold the cable in position at street corners, etc. The clamping of the cable by the clutch is gradual and uniform.

Mr. James Pardee, of Phillipsburg, Montana Territory, has patented an improvement in rotary ore-roasting furnaces, intended to increase the capacity, effectiveness, and working economies of this class of furnaces, and more especially applicable to what is known as the Howell rotary furnace. The improvement consists in a diaphragm or partition placed in the rear of the furnace feed pipe, by which means the crushed ore is given time to become heated and aggregated before dropping through the moving current of air and flame, and in this condition is not carried by the draught into the dust chambers in such quantities as heretofore.

Mr. James M. Totten, of Sharon, Wis., has patented an improved adjustable wrench. The shank has a socketed mortised block at the lower end, and a cross bolt passing through the shank, which holds side sliding plates. By sliding out the side sliding plates from the block and fastening them by the bolt, the wrench may be made to fit various sizes of nuts.

Mr. August W. Klamer, of Cahoka, Mo., has patented a draught equalizer for side reaping machines. A rectangular framework is adjustably secured to the tongue or pole of the vehicle, projecting on one side thereof and carrying the whiffletrees, thereby affording the horses a powerful leverage against the side pull of the machine.

Mr. Charles Steinfels, of Elizabeth, N. J., has patented a screw polishing machine, which automatically seizes and properly presents the heads of the screws to polishing wheels, the screws being fed to the machine in mass.

Mr. Heinrich Trenk, of Berlin, Germany, has patented a composition for use in tanning, consisting of a concentrated solution of crude tartar or argol, to which a small quantity of chloride of zinc or analogous chloride has been added. This composition is used after the hides or skins have been treated by the tanning liquor, and its action is to make the finished leather more dense and compact.

A hitching strap, patented by Mr. John D. Stotlemeyer, of Hancock, Md., prevents horses, when hitched, from falling, and assists them in recovering their feet when down. A portion of the strap is made of a strong strip of elastic rubber, provided with a snap hook, and suitably attached to the leather portion of the strap.

In an apparatus for watering stock, patented by Mr. James Ray, of Huntsville, Mo., a trough or receiver is provided with a device whereby water flowing into it from a pipe is automatically prevented from flowing as soon as the water reaches a prescribed level in the trough. The troughs may be arranged in a series, delivering water one to another, in such manner that none shall be wasted by overflow. A novel arrangement of float lever valves and float valves is used to accomplish the end sought.

A cheese cutter, patented by Mr. Lionel J. Smith, of Peshtigo, Wis., is so constructed that cheeses can be easily, accurately, and quickly cut into pieces of any desired size.

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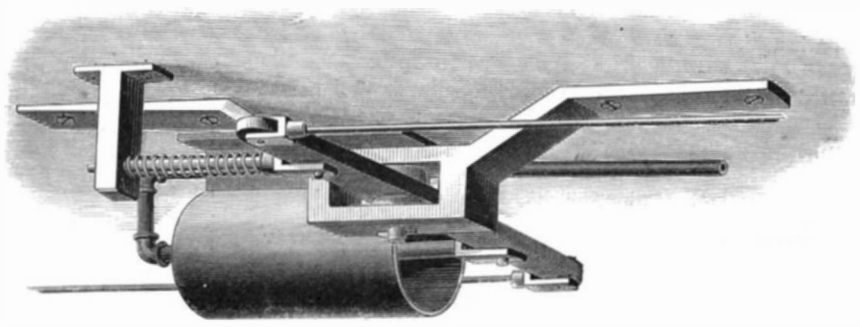
IMPROVED AIR BRAKE.

The construction of the brake shown in the annexed engraving is exceedingly simple, all unnecessary complication having been carefully avoided. As a consequence the first cost has been greatly lessened, the weight diminished, and the friction reduced, so that the apparatus may be made smaller than the ordinary form without detracting from its efficiency. The amount of the reduction of the weight amounts to about 140 lb., and the moving parts are reduced to a simple lever and a piston.

The arrangement of the mechanism is clearly shown in the engraving. The air cylinder receives air under pressure from a pipe extending from the engine through the entire length of the train. The forked end of the piston rod is connected with the lever by a pin passing through the fork and through a slot in the lever. The lever is retracted by a spring after being moved by the piston. Opposite ends of the lever are connected with the brakes at opposite ends of the car by the usual brake rods.

This simple mechanism may as readily be operated by a vacuum as by air pressure. The piston is moved more or less, and with greater or less force according as the air pressure is increased or diminished, and the brakes of the entire train are under the control of the engineer.

Further information may be obtained by addressing Messrs. Glenn, Cole & Jaques, Ottumwa, Iowa.



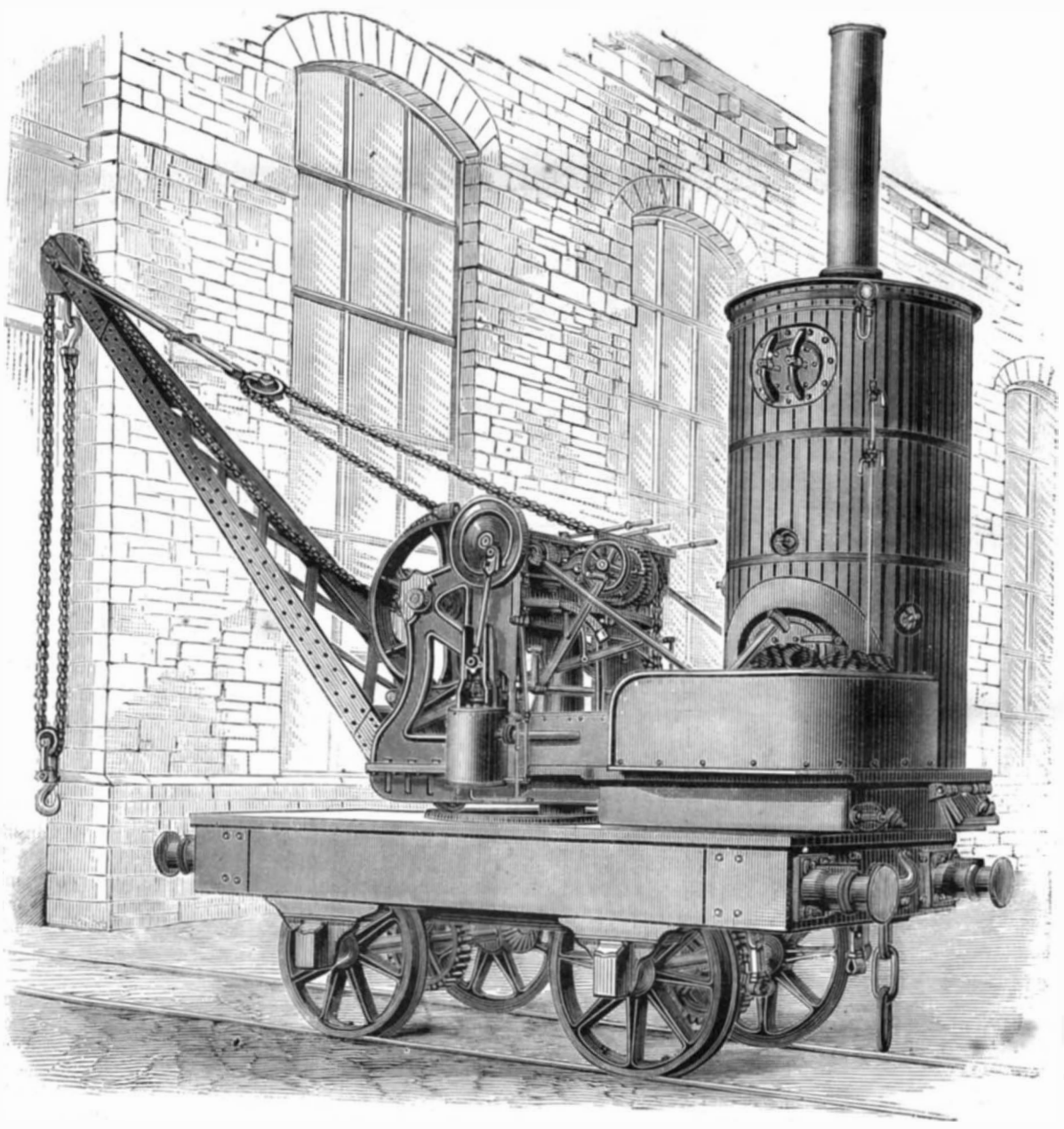
GLENN'S AIR BRAKE.

LOCOMOTIVE STEAM CRANE.

We give engravings of a locomotive steam crane designed and constructed by Mr. Thomas Smith, Steam Crane Works, Rodley, near Leeds, which is now working at the Barrow Shipbuilding Co.'s Works, and where it is employed in the erecting and fitting shops, also in the yard for shunting purposes. This pattern of crane was originally designed for Messrs. Pawson Brothers, of Morley, near Leeds, who have had one at work for a period of five months, loading material into ordinary railway trucks, and also for drawing two fully loaded trucks up an incline of 1 in 20, at the rate of four miles per hour, a distance of a quarter of a mile, the distance traveled altogether (and on which there are some sharp curves) from their works on to the main line being about a mile. The crane is fitted with two speeds for propelling (this motion being specially designed to meet the requirements of the case) quick and slow; the quick speed travels at the rate of seven miles per hour with a less weight or on the level road. To obviate the shock to the spur gearing, India-rubber springs are placed over the axle boxes, and the wheel base is such as to allow the crane to travel easily over ordinary curves. The gauge is the usual railway gauge.

The crane has single purchase hoisting motion, fitted with a powerful friction brake and catch, so that when required the crane can be propelled with the load suspended. The revolving motion is worked with a double friction cone, so that the crane can be made to revolve in either direction without stopping or reversing the engine, and to keep the crane from slewing round when on the incline, a small brake is attached on the first motion shaft. All the gearing is of the best crucible cast steel, and the central pillar is of best forged scrap iron.

The engines consist of a pair of cylinders 8 inches in diameter by 10 inches stroke, and are each fitted with link reversing motion, and crank shaft of steel. All the bearings are bushed with phosphor-bronze, and are adjustable. The boiler is of the ordinary vertical type, with three cross tubes through the fire box; the internal parts being of best Yorkshire iron. All the vertical seams are double riveted, and all the rivet holes are drilled in position. The boiler is fitted with the usual mountings, and also with a feed pump and a Giffard's injector. The tank is capable of holding a large supply of water, a great desideratum in a crane of this description, as it avoids the necessity of having to go for a supply between the ordinary meal hours. The crane is made to lift and propel with a load of five tons at a radius of 16 feet, and will lift heavier weights at a proportionately less radius, the power of the engine and strength of the gearing being such as to allow it to do this. The above mentioned weight can be lifted without fastening the crane down to the rails by means of clips. All the motions are within easy reach and control of one man, and the design generally is excellent. The total weight of the crane is twenty tons.—*Engineering.*



LOCOMOTIVE STEAM CRANE AT THE BARROW SHIPBUILDING COMPANY'S WORKS.

RECENT INVENTIONS.

Mr. George Egart, of Mooleyville, Ky., has patented a combined apple parer, corer, and slicer, by which the apples are pared as the mechanism is moved in one direction, and cored and sliced as the mechanism is moved in the other direction. The construction is very ingenious.

An improved neck yoke tip, patented by Mr. Charles Schuman, of Rockford, Ill., is both ornamental and useful. It permits the use of brass, or other metal that can be plated, for the ferrule plate or ring, while using iron for the loop; and also permits finishing the ferrule or plate in a lathe. The invention consists of a ring with a recess and a loop with a hook at one end, the hook end of the loop being placed in the recess of the ring, both ring and loop being then driven over the end of the neck and secured by a screw or rivet passed through the free end of the loop.

Mr. Seymour Van Nostrand, of Stormville, N. Y., has patented a vehicle spring, claimed to be of superior elasticity and strength, and having the important feature that by ingenious devices the elasticity of the spring can be increased or diminished at will to suit different loads.

Mr. James Smith, of Thornliebank, county of Renfrew, North Britain, has patented a dye and bleach vat more especially designed for the series of processes known in calico printing as dunging or treatment with dung substitute, but which is also applicable to bleaching and dyeing processes, etc. The apparatus is claimed to be far more convenient and compact than that heretofore used.

Mr. Heinrich Trenk, of Berlin, Germany, has patented a composition for tanning hides and skins. Two solutions are employed, mixed in the proportion of two of the first to one of the second. The first solution is composed of 25 parts pyroligneous acid, 25 parts chromate of alumina, in 1,000 parts of water. The second is a concentrated solution of crude tartar and a small quantity of chloride of zinc or analogous salt.

Mr. John McLeod, of Auckland, New Zealand, has invented a self-adjusting mast which is intended to increase the safety and improve the sailing qualities of boats and vessels. The mast is hung on trunnions on a thwart of a boat or beams of a larger vessel, and its foot rests on a curved tube with strong springs coiled around it. A counterbalance is secured about the foot of the mast to increase the inertia and to operate as self-adjusting ballast, and strong springs are also attached to the shrouds to assist in holding the mast in an upright position.

A pocket register for recording one's daily expenses has been patented by Mr. Frederick Horn, of St. Louis, Mo. Two small disks are marked with numerals on their outer faces, placed back to back and united at their edges for about three-quarters of their circumference. A movable disk that may be held fixed by a spring, has numbers, lines, and indentations on and about its edge, and is inserted on a pivot between the fixed disks. By turning the movable disk the amounts of separate expenditures are added to those previously recorded.

A root cutter, for cutting roots of trees, patented by Mr. Thomas Davies, of Fall River, Mass., may be used for the cutting of roots in felling trees without dulling the cutters, for cutting limbs from fallen trees, for splitting wood, and other purposes.

A water indicator for boilers, patented by Mr. John Bridges, of Leon, Iowa, consists of an arrangement of float pipes, levers, and an indicator, which operate in combination with a water supply tank, feed pump, and boiler for automatically regulating the height of water in the boiler and indicating the water level.

Mr. Louis D. Clairoux, of Detroit, Mich., has patented a fruit gathering apparatus, which consists in a novel construction, arrangement, and combination of a framework, apron, trough, and other devices, which provide for readily applying the apparatus to a tree and adjusting it to different positions. The fruit is received upon the yielding surface of the flexible apron, and, rolling to the center, passes into a trough, which conveys it, without bruising, to the ground.

An apparatus for conveniently retailing nails, nuts, and other articles sold by the pound and which facilitates the handling of such goods in getting them out and weighing them, has been patented by Messrs. Henry C. Draper and Thomas Bowyer, of Oswego, Kansas. The receptacles which hold the articles are hung on trunnions in a novel sort of frame, so that they can be turned down into a horizontal position for the more effective employment of the scoop or other implement used to take them out.

A device for extracting cartridge shells, patented by James F. Marvin, of Fort McDowell, Arizona Territory, provides a means whereby, when the heads are pulled off of cartridges, the shells may be easily extracted. A slotted expanding tube, with flanges and shoulders, and an expanding pin, is inserted into the shell. The closing of the breech expands the device into engagement with the metal of the shell, and when the breech is again opened the whole is extracted together.

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HELMET CRESTS.

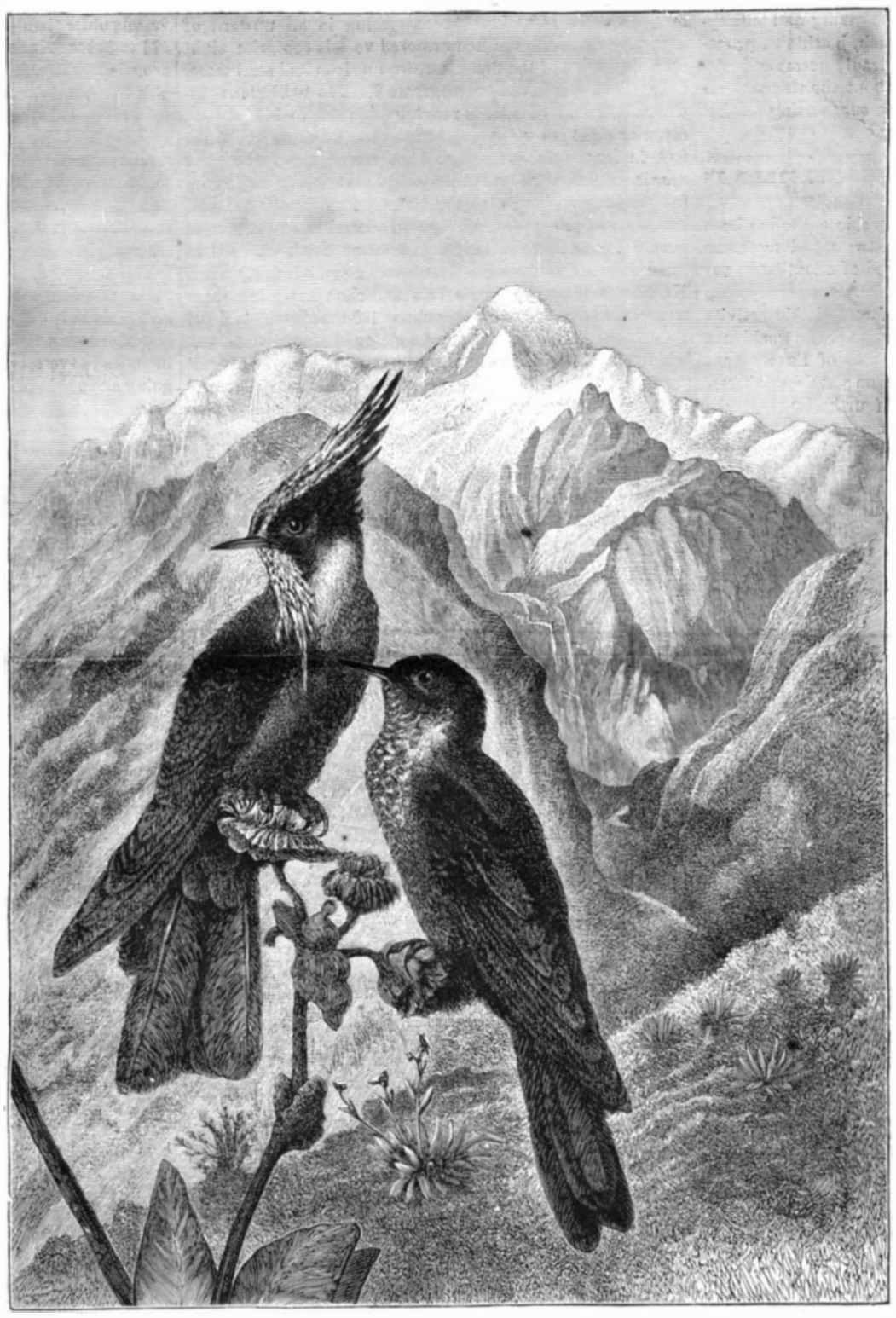
The helmet crests are very curious birds, and are at once known by the singular pointed plume which crowns the top of the head, and the long beard-like appendage to the chin. They all live at a very considerable elevation, inhabiting localities of such extreme inclemency that few persons would think of looking for a humming bird in such frozen regions. There are several species of helmet crest, and their habits are well described by Mr. Linden, the discoverer of Linden's helmet crest, in a letter written to Mr. Gould, and published in his monograph of the humming birds.

"I met with this species for the first time in August, 1842, while ascending the Sierra Nevada de Merida, the crests of which are the most elevated of the eastern part of the Cordilleras of Colombia. It inhabits the regions immediately beneath the line of perpetual congelation, at an elevation of from 12,000 to 13,000 feet above the level of the sea. Messrs. Funck and Schlim found it equally abundant in the Paramos, near the Sierra Nevada, at the comparatively low elevation of 9,000 feet. It appears to be confined to the regions between the eighth and ninth degrees of north latitude.

"It occasionally feeds upon the thinly-scattered shrubs of this icy region, such as the hypericum, myrtus, daphne, arborescent espeletias, and towards the lower limit on bejarias, but most frequently upon the projecting ledges of rocks near to the snow. Its flight is swift, but very short; when it leaves the spot upon which it has been perched, it launches itself obliquely downward, uttering at the same time a plaintive whistling sound, which is also occasionally uttered while perched, as well as I can recollect. I have never heard it produce the humming sound made by several other members of the same group, nor does it partake of their joyous spirit or perpetual activity. Neither myself nor Messrs. Funck and Schlim were able to discover its nest, although we all made a most diligent search.

"Its food appears principally to consist of minute insects, all the specimens we procured having their stomachs filled with small flies."

The head and neck of the adult male are black, a line of white running along the center. The long plumes of the throat are white. Round the neck and the back of the head runs a broad white band. The upper surface of the body and the two central tail feathers are bronze-green, and the other feathers are a warm reddish bronze, having the basal half of their shafts white. The under surface is a dim brownish bronze. The length of the male bird is about five and a quarter inches. The female is coppery brown upon the head and upper surface of the body, and there is no helmet like plume on the head nor beard-like tuft on the chin. The throat is coppery brown, covered with white mottlings, and the flanks are coppery brown washed with green. The length of the female is about one inch less than that of her mate.—*Wood's Natural History.*



LINDEN'S HELMET CREST OR BLACK WARRIOR.—(*Oxypogon Lindenii.*)

Novel Employment of Elephants.

Recently, at Bridgeport, Conn., a switch locomotive having run off the track, two of Barnum's largest elephants were brought out and made to push the locomotive with their heads. They succeeded in righting the machine after one or two attempts, but their exposure to the winter air gave the animals bad colds, and to cure them it was necessary to give them several gallons of whisky.

White Negroes.

At a recent clinical lecture at the College of Physicians and Surgeons, Professor George Fox intoduced the "African leopard boy" now on exhibition in this city. According to Dr. Fox the boy is eleven years old and of pure negro parentage, and at birth was entirely black. White patches began to appear on his body when he was three years old, until now a large part of his arms, chest, abdomen, and legs, in irregular blotches is white, and the skin around the blotches is a *cafe au lait* color. There is also a white spot on his forehead, extending several inches back on his head, and the hair on the white spot is also white, although as kinky as a colored boy's hair should be. Except as to color, the skin is entirely normal. The face, neck, hands, feet, and back are entirely black. The white area is increasing annually, and Dr. Fox predicted that some day the boy would become an entirely white negro. His diagnosis of the disease was leucodermis, and he said it was not rare, as half a dozen entirely or nearly white negroes, he presumed, could be found in this city. The disease was one, like albinism, to which all races and many animals are subject. But most cases of white crows, blackbirds, rats, mice, and elephants are cases of albinism. Albinism differs from leucodermis in that it is congenital, and patches do not increase or decrease. Children of an albino negress and a black negro are always either entirely white or entirely black.

The Mastodon.

Prof. G. C. Brodhead contributes to the Kansas City *Review* an interesting paper, in which he enumerates all the discoveries that have been made of mastodon remains in the United States. This huge animal appears to have had a wide range in this country in past ages. The earliest record that we have of the finding of the bones of the mastodon is contained in a letter from Cotton or Increase Mather to the Royal Society of London, between 1650 and 1700, describing the portions of the skeleton of one of these animals discovered near Albany, N. Y. Since that period skeletons nearly entire, detached bones, teeth, etc., of the mastodon, have been found in nearly every State in the Union, including those of the Pacific slope. The evidence thus far obtained goes to show that the mastodon first appeared in America in Miocene times, was abundant in the Pliocene, and lingered until the close of the Glacial period, and disappeared in the early Loess. We also find that he roamed at will from Canada to South America, being found as far north as 66° N. latitude on our Western Coast.

Cape Breton Oil Wells.

The oil belt at Lake Ainslie, Cape Breton, is being prospected with considerable promise. The Cape Breton Oil and Mining Company are now sinking a well half a mile from the western shore of the lake, and have reached a depth of 1,000 feet. The prospects are said to be good, the oil being of a quality exceptionally valuable. The local manager of the company intends, he says, to sink twelve wells in his district. Three other Boston companies have entered the field, one having contracted for ten wells, the other two for three wells each, so that in the course of the year it is expected that twenty-eight wells will go down. The Cape Breton oil is a heavy lubricating oil.

Improved Caustic.

It sometimes becomes necessary to remove certain morbid growths in the throat and elsewhere, and for this purpose a stick of fused nitrate of silver secured in a quill is generally employed. Unfortunately it not unfrequently happens that the caustic breaks off and slips down the throat. To prevent this a Russian surgeon melts together 5 parts nitrate of silver and 1 part nitrate of lead. This composition does not break easily, and can be sharpened like a lead pencil. It should be fastened in a quill made of metallic aluminum, which is not corroded by the caustic as metallic silver is.

Joseph Smith's Tree Root Museum.

Mr. George Jacob Holyoke describes, in the Manchester *Co-operative News*, a remarkable museum of oddities carved out of laurel roots by Joseph Smith, Wissahickon, Pa., the most original thing he saw in America. Mr. Holyoke expected, from his early acquaintance with the man, to find the museum commonplace and pretentious. Instead he found a number of rooms bearing the appearance of a forest of ingenuity, which a day's study would not exhaust. There was nothing tricky about it. Its objects were as unexpected as the scenes in the Garden of Eden must have been to Adam. Noah's ark never contained such creatures. Doré never produced a wandering Jew so weird as the laurel Hebrew who strode through these mimic woods. Scenes from the Old Testament, groups of American orators, statesmen, and railway directors started up in the strange underwood, or held forth in the branches of trees. Dr. Darwin would require a new theory of evolution to account for the wonderful creatures—beasts, birds, and insects—which confront you everywhere. An American Dante, if there be such a one, might find ample material for a new poem in this wooden inferno. The mind of man never conceived such grotesque creatures before; yet this was the work of an old agitator, executed between his seventieth and eightieth year, with no material but roots of trees, with no instrument but his pocketknife and a pot of paint, and no resources but his marvelous imagination. There were snakes that would fill you with terror; stump orators that would convulse you with laughter. His Satanic Majesty strode on horseback; Mrs. Beelzebub is the quaintest old lady conceivable. The foreign devils all had a special individuality. There was the Mohammedan devil, the Indian devil practicing the Grecian bend, the Russian devil eating a broiled Turk, the Irish devil bound for Donnybrook Fair, the French devil practicing polka, the Dutch devil calling for some beer, the Chinese devil delivering a Fourth of July oration. Mr. Holyoke saw no American devil, and hoped we were without one. Mr. Smith's description of his creations endowed every creature with living attributes. He illustrated his favorite doctrine of man being the creature of circumstances, by saying it was coming to live in Schuylkill County which first developed in him the latent slumbering organ of rootology.

Dust and Fog.—Beneficial Effects of Smoke.

Mr. John Aitken recently read a paper before the Royal Society of Edinburgh on the origin of fogs, mists, and clouds. From a great number of experiments with moist air at different temperatures, to determine the conditions which produce condensation of water vapor, he concludes that whenever water vapor condenses in the atmosphere, it always does so on some solid nucleus; that dust particles in the air form the nuclei on which the vapor condenses; that if there were no dust there would be no fogs, no clouds, no mists, and probably no rain; and that the supersaturated air would convert every object on the surface of the earth into a condenser on which it would deposit as dew; lastly, that our breath, when it becomes visible on a frosty morning, and every puff of steam, as it escapes into the air from an engine, show the impure and dusty state of the atmosphere.

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These results have been verified at temperatures as low as 14° Fah., at which, however, there was little cloudiness produced, owing to the small amount of vapor in air so cold. The sources of this dust are many and various; for instance, finely ground stone from the surface of the earth, the ash of exploded meteorites, and living germs. Mr. Aitken showed experimentally that, by simply heating any substance, such as a piece of glass, iron, or wood, a fume of solid particles was given off, which, when carried along with pure air into a receiver, gave rise to a dense fog mixed with steam. So delicate is this test, that the hundredth of a grain of iron wire will, when heated, produce a distinct haziness in the receiver. By far the most active source of these fog-producing particles is, however, the smoke and sulphur given off by our coal fires; and as even gas grates will not prevent the emission of these particles, Mr. Aitken thinks it is hopeless to expect that London, and other large cities wherein such fuel is used, can ever be free from fogs. However, inasmuch as more perfect combustion will prevent the discharge of soot flakes, these fogs may be rendered whiter, purer, and therefore more wholesome, by the use of gas grates, such as that recommended by Dr. Siemens. Mr. Aitken also drew attention to the deodorizing and antiseptic powers of smoke and sulphur, which, he thinks, probably operate beneficially in killing the deadly germs and disinfecting the foul smells which cling about the stagnant air of fogs, and suggests caution lest, by suppressing smoke, we substitute a greater evil for a lesser one.

THE NAVIES OF EUROPE.—TEN YEARS' PROGRESS IN SHIPS OF WAR.

In recent issues of this paper considerable space has been given to the consideration of our coastwise and maritime defenselessness, and to the pressing need of attention to our naval weakness.

The past decade has been a period of remarkable activity and creative progress in all the navy yards of the world save ours. During this time the great powers of Europe have substantially reconstructed their navies on a scale previously undreamed of; and even the third and fourth rate powers of the world have so increased their war fleets as to place us in a decidedly precarious position navally should a controversy with either or any of them suddenly arise. There is happily no present indication of foreign war, but a war is always possible; and it ill-becomes the richest nation in the world to be doing nothing for the protection of the exposed wealth of its seaports, or for putting itself in position to command respect—the surest guarantee of peace.

According to the recent report of the Navy Department the strength (more correctly, weakness) of the United States Navy is summed up as follows:

In Commission—Steamers, 29, sailing ships, 4; monitors, 8; torpedo boats, 2; total, 43. In Ordinary—Steamers, 18; sailing vessels, 8; monitors, 7; steamers, 3; sailing ships, 3; monitors, 1; steamer, 1; sailing ships, 3. On Stocks—Steamers, 5, sailing ship, 1; monitors, 4; ironclad, 3. Repairing—Steamers, 9. At Naval Academy—Sailing ships, 3; monitors, 1. Public Marine School—Sailing ship, 1. Tugs of all kinds at yards and stations, 25. Total number of vessels, 139.

Of these vessels, constituting the general service fleet, six are double-turreted armor belted monitors, only one of which is finished or near completion—the rest are rotting on the stocks; fifteen are single turreted monitors built from fifteen to eighteen years ago, and now practically worthless; five are unarmored screw steamers (frigates), the youngest, the flag ship Tennessee, being fifteen years old; twelve second-rate and twenty third-rate corvettes, all but one second-rate (the Trenton) and half a dozen third-rates being ancient and of small value; four paddle steamers, all ancient; two torpedo vessels, and a dozen small gunboats, only two of which are yet armed. Some of these vessels carry small rifled guns (altered from smoothbores), and all are slow, very few exceeding ten knots.

The navy of Great Britain presents a remarkable contrast. It now comprises, according to the careful summary of Mr. King ("War Ships and Navies of the World," by Chief Engineer J. W. King, U. S. N. Boston: A. Williams & Co. 1880), nearly four hundred vessels of all kinds, excluding those laid up or employed in permanent harbor service. These vessels are divided into three classes: ships for great naval battles, ships for coast defense, and unarmored cruising vessels. Of the first class of heavily armored sea going fighting ships, armed with powerful guns, there are now twenty-eight, carrying 254 guns, weighing in all 4,493 tons. Eleven of the ironcladsare sea-going turret ships—nine masted and two rigged—and seventeen are broadside ships, of which three are armor-belted cruisers. The coast defenders number fifteen, and the iron broadside ships of the original type number ten. In addition, two iron-plated wooden ships remain serviceable. These are all large ships; nearly all are of recent construction, the average expenditure on new armored ships, according to Mr. King, being about fifteen million dollars a year, while nearly four millions are spent on other new vessels. The first-class turret ships range between 270 and 330 feet in length; 6,200 to 11,406 tons displacement; carry guns of from 25 to 80 tons; and can steam from 12½ to 15 knots an hour. The first-class broadside ships are from 230 to 325 feet in length, and, with one exception, exceed 6,000 tons displacement, rising as high as 9,500 tons. They carry guns of from 12 to 25 tons, and all make better time than the fastest American corvettes, or between 12 and 15 knots. The armor belted ships are but slightly smaller and less powerful. The coast defenders are improvements on our monitors in size, speed, and armament. Most of the old-type iron broadside ships are larger than our Tennessee; are armored, carry guns from 6½ to 12 tons, and can steam from 12 to 15 knots.

The lately built unarmored ships of the British Navy include three iron frigates, six iron corvettes, two steel dispatch vessels, nine steel and iron corvettes, six composite corvettes, fourteen first-class composite sloops, and six second-class, with a hundred composite gun vessels and gun boats. The frigates steam from 15 to 16 knots; the first-class corvettes from 13 to 15 knots; the second-class 11 knots; the dispatch boats, both as large or larger than the Trenton, have exceeded 18 knots.

The old-type steam cruisers of wood and iron in the general service fleet are by no means of small importance, though they do not properly fall within the scope of this article. This fleet comprises fifteen ships of the line, twelve frigates, twenty corvettes, ten sloops, thirteen troop ships, supply ships, dispatch steamers, yachts, surveying vessels, etc.

The new fighting fleet of France practically dates from 1872, when a programme was drawn up for the construction of 217 vessels of various types, costing in all upward of $121,000,000. The finished armored vessels comprise eight sea going ships of the first class, iron or iron and steel rams, from 311 to 322 feet in length, from 8,133 to 10,332 tons displacement, and of speeds ranging from 13 to 14½ knots; seven or eight sea-going ships of the second class, about 250 feet in length, from 4,000 to 6,000 tons displacement, and speeds of from 13 to 14 knots; fifteen coast defenders, from 216 to 241 feet in length; sixteen first-class wood and iron ships of old types, and eight of second-class, the former from 272 to 284 feet in length, the latter 230 feet. All of these ships are armed with breech-loading rifled guns. When Mr. King's table was made two first-class sea-going ships were building, each to carry three 100-ton guns. All the French sea-going armored ships are rigged; the mastless vessels for coast defense include six turreted vessels; all the rest are on the broadside principle, or have the broadside and turret principles combined. The heaviest guns are mounted *en barbette*. Both the armored and unarmored modern ships have the ram bow.

Of the latter type of vessels the programme of 1872 contemplated eight first-class, eight second-class, and eighteen third-class cruisers, eighteen dispatch vessels, thirty-two gun boats, and thirty-five transports. A large portion of these are already afloat. By 1885 it is expected that the entire fleet will consist of new vessels of the most approved modern types armed with the best modern guns, all in perfect condition for service.

The list of the old-type steam cruisers, mostly of wood, given by Lieutenant Very ("Navies of the World," by Lieut. Edward W. Very, U. S. N. New York: John Wiley & Sons. 1880), includes nine ships of the line, six frigates, ten corvettes, twenty one sloops, eleven dispatch vessels, and forty-two transports.

The fleets of Germany and Italy are almost entirely the work of the past decade or so. It is only since 1860 that Germany has had any navy at all, to speak of, and since 1873 that any attempt has been made to acquire a navy commensurate with the importance of the empire on land. The armored ships afloat or building comprise six casemate ships, 213 to 280 feet in length, 7,135 to 7,560 tons displacement, speed of 14 knots, and armed with Krupp guns of from 18 to 36 tons; two armor-belted turret ships, with casemate around turret, 298 and 308 feet in length, about 6,500 tons displacement, 14 knots speed, and armed with Krupp guns, the largest being of 18 tons; three large broadside ships; one corvette, and eight or ten coast defenders, of 1,000 tons displacement and slow speed. The latter carry each a 36-ton Krupp gun, in a movable turret protected by an armor parapet. None of these will be able to match the larger ironclads of England, or the Italian Duilio or Dandolo; but will have a strength sufficient, perhaps, to meet the French under any conditions proffered.

The modern unarmored ships of Germany include seven fast iron corvettes, 2,460 to 3,873 tons displacement, carrying from 12 to 16 guns each, having covered gun decks; and six open deck corvettes of 2,169 tons displacement; three fast dispatch vessels (16 knots), and five gun boats.

The modern war fleet of Italy dates from 1877, and comprises the most powerful and heavily armed vessels ever built. The Italian ships are specially remarkable for the heavy guns they carry and their great speed. The broadside ships Italia and Lepanto, now building, are 400½ feet long, 13,480 tons displacement, are expected to steam 16 knots, and will each carry four 100-ton Armstrong guns, mounted in pairs *en barbette*, and 18 smaller guns. The mastless turret ship Duilio lacks an inch of 341 feet; its displacement is 10,401 tons; it carries four 100-ton guns, and makes 15 knots. The unfinished Dandolo is in every respect its counterpart. The four line of battle cruisers already afloat are from 250 to 265 feet long, and though lightly armored are heavily armed, two of them carrying one 23-ton and six 18-ton guns, the other two carrying six 18 ton guns and two 12-ton guns. There are besides one monitor ram, four floating batteries, and six broadside frigates, for coast defense and station service. The unarmored fleet numbers ten fast cruisers, of which three are second-class corvettes, four gun boats, and three torpedo vessels. By the decree of 1877 it was determined to have completed by 1888 sixteen ships of war of the first class; ten of second class for local defense, for cruisings, and for foreign stations; and twenty vessels of third class; twelve transports, and twelve small ships for local service, a programme which is rapidly being carried out, as already shown.

Two years ago the Russian Navy included thirty-one armored ships and a couple of hundred other vessels. The armored ships were: frigates, 6; battery ships, 3; turret ships, 5; Popoffkas, 2; double turret monitors, 3; single turret monitors, 12. The more powerful of the Russian war ships have been launched since 1874. The double turret ship, Peter the Great, is 330 feet long, is of 9,510 tons displacement, carries four 40-ton guns, and has made 13 knots. The Knatz Minin is another powerful ship, 389 feet long, 5,800 tons displacement, and carries four 28 ton guns, mounted in pairs *en barbette*. The two Popoffkas are floating citadels of circular form, designed for service in shallow water. The latest novelty is the turbot-shaped Livadia, ostensibly a yacht for the Czar, but doubtless intended, in case of need, to be heavily armored and armed for naval uses. During the past five or six years Russia has also been expending large sums on unarmored fast cruising ships, this arm of the navy having already become formidable.

The armored fleet of Austria contains but three or four vessels older than 1870. It comprises three redoubt frigates, 276 to 302 feet in length, 5,940 to 7,390 tons displacement, armed with 10 and 11 inch Krupp guns (18 to 28 tons), and able to make from 13 to 14 knots; five casemate frigates, 223 to 275 feet in length; three broadside frigates, of 197 and 253 feet length; two monitors, and one citadel ship. The smaller frigates are armed with 7 and 8 inch guns, and make from 11 to 13 knots. The last mentioned vessel carries two 17 inch Armstrong guns. The unarmored fleet contains a considerable number of recent cruisers of fair speed and efficiency.

The navy of Holland is chiefly strong for defensive purposes, and comprises but two sea-going armored ships. The armored ships of Spain are few and of small importance compared with those of other European powers. The list includes 138 vessels of all kinds, but there are no modern sea-going armor-clads and no cruisers of the rapid type. Denmark has launched two iron-clads since 1873, the frigate Odin, carrying four 18-ton guns; and the broadside, casemated, central battery ship Helgoland, launched in 1878. The half dozen other armored vessels are old. The Swedish navy is designed chiefly for coast defense. This arm comprises four armored monitors, ten armored gunboats, and about a hundred other vessels of all sorts. The navy proper comprises 38 unarmored vessels. Portugal has one armored ship, ten screw corvettes, nine gunboats, and half a dozen sailing vessels, transports, etc. Norway has four monitors, one frigate, four corvettes, and about a hundred gunboats and other small vessels. Greece has fifteen vessels, including two ironclads. Turkey has vessels enough to rank among the naval powers, but lacks money and officers to make them effective. Fifteen of her ships are large and fairly armed.

The chief lesson taught by the costly naval experiments of European powers during the past decade—a lesson which the United States can profit by—seems to be the inexpediency of building huge floating fortresses at enormous cost. The power of guns can be increased more rapidly than the ability of ships to withstand them; and the greater the target the greater the chance of being hit, and the greater the loss of life and property when a crushing blow has been struck.

For defense against the largest class of ironclads we need properly placed stationary coast defenders, the armor of which can be increased as the power of the guns to be resisted is increased. The superior accuracy of fire possible in a land battery will make one heavy gun, so placed and guarded, more formidable than many guns of equal weight on shipboard. For naval purposes a large number of small vessels of great speed, each carrying one heavy gun, will be more efficient than a few large armor clads of equal aggregate cost.

The Scientific American.

While the newspaper press of the day is, for the most part, inculcating more of error than of truth in the public mind in regard to medical topics, cultivating the vulgar superstitions by circulating every sensational story about madstones and blood stones and the like, and gloating over every report of the desecration of graves for anatomical purposes, it is refreshing to turn to the pages of the periodical above named, and to observe that whenever medical topics are introduced, it is with the design of imparting the truth and inculcating correct ideae. Many years of growth have raised the SCIENTIFIC AMERICAN to the front rank, so that there is not in any country a publication superior to it in its sphere.
—*Pacific Medical and Surgical Journal.*

Photographic Emulsions.

BY H. W. VOGEL, BERLIN.

The essence of the invention consists in combining gelatine and bromide of silver with pyroxiline by the use of a new solvent, which insures the homogeneous mixture of the two. The solvent may be one of the inferior members of the fatty acids, such as formic, acetic, propionic acid, etc., or mixtures of the same alone or with alcohol, etc. Four various methods of producing the combination are described, of which the first is as follows: Ordinary gelatine is dried and dissolved warm in one of the above-mentioned acids, and one per cent of pyroxiline dissolved in a similar acid is added.

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Machinery and Civilization.

Mr. Charles C. Coffin has been giving a series of lectures in the Lowell (Mass.) Institute on our manufacturing industries and the relation of invention to civilization. From the Boston *Advertiser* we make the following extracts from one of these lectures:

The first need of men in this world is for something to eat; the second is for something to wear. The earliest historical allusion to the manufacture of textile fabrics is the simile in the oldest poem extant—the Book of Job—the comparison of the swiftness of time to the weaver's shuttle. The weaver's shuttle of the East and the loom of the Orient through all the centuries have not changed. Throughout Asia, and even in some sections of Italy and Spain, the spindle of to-day is like that which Penelope deftly twirled when preparing garments for her absent lord. The use of machinery in the manufacture of clothing has been a powerful agency in modern civilization. Out of the multitudinous machines of the present century I select those for spinning and weaving to represent the progress of mechanic art. It is noteworthy that the first movement in free intellectual thought in antagonism to the dogmatism of the Middle Ages and the first mechanism to relieve woman from unceasing toil were coincident. During those years in which Martin Luther, Melanchthon, and their compeers were awaking the world to a new intellectual and religious life, a German carpenter constructed the spinning wheel, which made its appearance about 1530. The knitting machine was the second invention—the device of a young curate of Nottingham, the Rev. William Lee; and during those months when the Mayflower was crossing the Atlantic, the first stockings knit by the machine were placed on the market.

The lecturer commented upon the fact that the century following Lee's invention rolled away without any invention. Men were giving their attention to other things. The spirit of the age was against invention. The learned were lost in abstractions, were regardless of human needs, utterly ignorant of the resources of nature to alleviate human woe or to lift men to a higher plane of life. Another reason why inventions did not come earlier was that all christendom, through the Middle Ages and down to the beginning of the present century, was engaged in war. The conditions were all adverse to scientific research. In 1781, just one hundred years ago, came Watt's first working engine, with a condenser and the steam applied to propel the piston in both directions.

Aside from the very few wind and water mills, the human race at the beginning of the present century was living by its own muscular energy, digging and delving, spinning and weaving, with rude instruments and mechanisms.

The world is more enlightened now, but there are still many people who cannot see how the introduction of a machine which will do the work of many men can be promotive of the well being of the community. Imagine yourselves as standing on the bank of the Merrimac in 1821, with Nathan Appleton, William Appleton, Patrick T. Jackson, Kirk Boott, John W. Boott, Paul Moody, and Nathaniel Bowditch. No sound breaks the stillness, save the rushing of the water over the rock. It is the energy of nature running to waste, and these gentlemen determined to set it to work for their individual welfare. They purchased the surrounding farms and the old canal which other men had constructed for the passage of rafts, set themselves to enlarging it, and in building a dam, not working with their own hands, but summoning the farmers, who came with their oxen to haul rocks. Stonemasons are wanted, and the blacksmith to sharpen their tools. Young men come down from Vermont and New Hampshire to dig the canal. The gentlemen who are pushing the enterprise need bricks. Another class of laborers is called for. Lumber is needed, and sawmills are set to humming. Masons, hodcarriers, mixers of mortar, lime burners, are set to work, with still more oxen, more teamsters and cartmen, besides coopers to make the casks for the lime. An architect plans the manufactory; the carpenters frame it, and a corps of joiners finish it. A millwright calculates the power, sets another corps of men at work constructing the great wheel. The manufacturers of the spinning and carding and weaving machines have regiments hammering and filing brass, steel, and iron. They in turn have set the founders, puddlers, and smelters to work. Furnaces send up their lurid flames; vessels are sailing on the ocean to fetch and carry the materials. The miners far down in the earth, the sailor climbing the shrouds in mid-ocean, the millwright lost in thought, as he calculates the power of nature's energy, the brickmaker moulding the plastic clay, the joiner plying his plane, the teamster urging his cattle; all have been called from former vocations to aid in building the mills. Why have they come? Because these gentlemen offer them more remunerative wages than they have been receiving.

Let us follow on. The mills are erected, the machines are in place, but human hands are still needed. The gentlemen summon the farmers' sons and daughters by the inducement of better wages. Have the gentlemen thrown any one out of employment? They have changed labor; they have made the spinning wheel and loom of the household useless lumber, not throwing the old-time spinners and weavers out of employment, but transferring them to one in which they can do more for themselves and their fellowmen. You ask, perhaps, what the masons joiners, and carpenters who built the mill are to do when the mill is completed? Are they not out of employment? The mill is only the beginning. Dwelling houses are needed, stores, shops for the grocer, butcher, baker, joiner, mason, blacksmith—the whole fraternity of trades and occupations. The first mill erected at Lowell was the beginning of a city to-day numbering between 50,000 and 60,000 inhabitants. It will be instructive in this connection to see what labor and capital together will accomplish through the use of the energy of nature, in giving value to raw materials.

The Southern farmer plows his lands, casts in the cotton seed. He sells his crop at 12 cents per pound, obtaining a livelihood by agricultural labor. The operative in Lowell, by manufacturing it into muslin, may make it worth 80 cents, by more delicate manipulation into lace worth $1. But before the process could be undertaken by the machinist, the iron manufacturers were called upon to construct the machinery. The ore which the miner dug from the ground, and which he sold for 75 cents, the iron smelter sold for $5. The machinist makes it worth $100. If instead of putting it into spindles and wheels, it had been sold to the manufacturer of fine needles, he would have made it worth $6,800. The manufacturer of watch springs would have made it worth $200,000; or if he were to use it for pallet arbors it would be worth $2,577,595. Past earnings and present labor together give this increased value to the 75 cents' worth of ore.

Invention renders old things obsolete and so is destructive; but there is a force more destructive than invention, a force that not only drives men from occupation, but upon the instant consigns their costly machines to destruction—a force wielded almost wholly by the female sex—the force of fashion, a power stronger than the combined strength of inventors, manufacturers, and operatives. Not long ago every woman in this audience quite likely regarded a hoop-skirt as necessary to make her wardrobe complete. Probably not less than 25,000,000 were manufactured per annum, requiring an outlay of many millions of dollars for complicated machinery, furnaces, and rolling mills for the foundation of steel, manufactures for the weaving of tape, employing many thousand operatives; but suddenly the idea gained possession of the female mind that dress would be more graceful and pleasing to the eye without them, and they were upon the instant discarded, bringing about quick destruction to the manufactures and loss of occupation to the operatives.

Invention is an educator. It begins with thought. The more thought put into his machine by the inventor the higher the intelligence to operate it. Mechanics has become a distinct profession, requiring high mathematics, physics, and the power of abstract thought. Trade and commerce recognize the new profession by offering it their highest pecuniary rewards. It is the master mechanic, receiving his salary of $15,000 per annum, who is the cheapest employe of some corporations in this country. Fifty years ago, in 1830, the spindles of the world were as follows: United States, 1,000,000; Europe, 2,000,000; Great Britain, 8,000,000. To-day the United States has 11,000,000; Europe, 20,000,000; Great Britain, 40,000,000. In cotton manufacture it is estimated that one man to day is able to do the work of 1,000 hand laborers, and that the cotton, silk, and woolen industries of to-day would require the labor of every human being if prepared by hand labor.

One hundred years ago, when thread numbered 150 by the standard set up by spinners was considered the utmost degree of fineness possible by English spinners, a pound of cotton spun to such fineness would give a thread 74 miles in length, sufficient to reach from Boston to Concord, N. H. The machinery of to-day spins for useful purposes thread numbered 600—from one pound a thread 196 miles in length. And machinery has been constructed so delicate that a pound of cotton has given a thread reaching 1,061 miles—farther than from Boston to Chicago! The weaver of my boyhood could throw the shuttle perhaps twenty-five times a minute, but not at that rate through the day. Human muscle would break down under such rapid action. In 1850 Compton's loom threw the shuttle fifty times a minute, whereas so great has been the advance of invention, that the loom of to-day is considered a slow moving mechanism if the shuttle does not fly 240 times a minute! "No man can afford to take as a gift to-day a cotton manufactory equipped with the machinery of 1860," was the remark of the late superintendent of the Amoskeag Mills. "We are breaking up the machinery of those days for old iron."

In some departments of cotton manufacture a man with the present machines will do eight times the amount of work which he could accomplish in 1860. In the manufacture of coarse cloth an operative with ten machines does twice the work which he could accomplish with thirteen machines before the war. There never was a period so fruitful in discovery, so fertile in invention as the present, and the reason is manifest. The first discoverers and inventors groped in the dark. They were ignorant of nature's laws. They did not know what force was. They had a limited comprehension of what the simple mechanical powers were. There was little accumulated wealth of research.

In contrast, the mechanic of to-day has all the discoveries, the experiments, the ascertained facts, mathematics of machinery, the laws of force at his command. He inherits the scientific wealth of all the past and makes it his capital. Instead of gazing, as it were, upon old mines worked out, he beholds mountain ranges filled with golden ore, and engages in his work with the stimulus of the needs of the human race, and the ever increasing wants of an advancing civilization.

Repairing Steamers Out of Dry Dock.

Some weeks ago the steamship Queen, of the National Line, had her bow stove in by collision on the bay. To save the heavy cost of occupying the dry dock while the plates were being made for repairing the breach, the Queen was towed to the Erie Basin, where the manager of the line, Mr. Hurst, had the work done by means of a cofferdam, which was built on the dock. The dam was about 25 feet square, and was simply a huge box without a cover. In one side of this box an aperture was cut into which the bow of the vessel exactly fitted. Then the box was sunk beneath the steamship and raised under her bow so that it fitted snugly to her hull and the edges were calked. After the water had been pumped out the workmen descended into the box or cofferdam and rebuilt her bow. This method of repairing, which is an old but much neglected one, saved the company, Mr. Hurst is reported to say, just $26,000.

More recently the method has been applied to the iron steamship Holland, of the same line. Mr. Hurst says: "In the November gales she was all torn to pieces about the stern. She is 450 feet long and is registered at 4,000 tons burden. No dry dock in America could lift her. She is at our dock at Houston street, North River. I had a coffer dam built in Jersey City and towed to the Holland. The dam is 36 feet long, 26 feet wide, and 22 feet deep. I sent a carpenter into the hold of the Holland, and he took measurements every 2 feet from keel to deck. He then went on the dock and built a flat pattern the exact shape of the vessel about 10 feet from her stern. The shape of the pattern was cut from one side of the coffer dam. Then the coffer dam was towed to the vessel, heavy chains were thrown into her until she sank, the chains were then withdrawn, and the dam rose to the hull of the steamship. The stern fitted perfectly into the aperture, and all was made snug." The repairs will take till February 15. By that time the charge for dockage would have amounted to over $30,000, which is saved by the use of the coffer dam.

A Large Iron Steamboat.

The Fall River Steamboat Company announce that a contract has been signed with John Roach & Son for the construction for them of an iron steamboat, to be the largest ever built for the Long Island Sound trade, between New York and Fall River. Her length over all, on deck, will be 395 feet; length of hull, 380 feet; extreme breadth of beam across the guards, 87 feet; breadth of beam of hull, 50 feet, and 17 feet depth of hold. She will be built upon the cellular system, that is, with two hulls—the most recent type of shipbuilding insuring safety—the cellular spaces at the sides being two feet deep, and along the bottom three feet deep, between the hulls. The spaces between the two hulls will be divided into ninety-six watertight compartments, and, in addition, there will be six water-tight bulkheads from the inner hull to the main deck. The new boat will be provided with a steam steering apparatus, and an independent or safety-steering quadrant aft, in case of accident to the steam gear. The means for extinguishing fire, for closing one compartment from another, and other provisions for safety, will be on the latest improved methods. The engine will be on the "walking beam" principle, with 110 inches diameter of cylinder and fourteen feet stroke. There will be four main boilers, their construction being such as to warrant carrying a pressure of steam fifty pounds to the square inch, although the working pressure will be about twenty-five pounds to the square inch. The paddle shaft will be twenty-six inches in diameter, and with the piston rod, connecting rods, and rock shafts, will be made of the best wrought iron. The machinery will be inclosed in a compartment of longitudinal and athwartship bulkheads, carried up to the hurricane deck. The passengen accommodations are intended to be superior to those of any steamboat now afloat. The boat is to be completed by May, 1882.

AGRICULTURAL INVENTIONS.

Messrs. Anthony W. Byers and James C. Dorser, of Sherman, Texas, have patented a cotton planter so constructed that it can be adjusted to plant less or more seed, as required. There is an ingenious arrangement of spikes or prongs attached to the rim of the feed wheel, which take hold of the cotton seeds and draw them out between curved steel springs fixed in the slot in the bottom of the feed board or bottom of hopper, and at the sides and forward end of this slot are attached springs which are curved downward and outward in such a manner that their bends may meet, or nearly meet, within the slot, so as to prevent the seeds from passing out except when pushed out by the prongs of the feed wheel and thus prevent the seeds from being dropped in bunches. The outward curve of the ends of the springs allows the seeds to drop from them freely, and allows the prongs of the feed wheel to pass up between the springs should the said feed wheel be turned backward.

Mr. Julius Holekamp, of Comfort, Texas, has patented a seed planter whereby corn, sorghum, beans, rice, cotton, etc., may be planted in hills or drills, and so constructed that the seed may be planted in any desired quantity, and at any desired distance apart, and with the rows at any distance apart.

Mr. Christian E. Gardner, of Orangeburg, S C., has patented a seed planter and fertilizer-distributer, which has two hoppers and dropping devices whereby different materials may be carried and distributed by the same machine and at the same time. Adjustments are provided whereby the machine may be used either as a single or double planter.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The H. W. Johns Mfg. Co.'s new colors of Asbestos Liquid Paints are particularly appropriate for large structures, such as manufactories, churches, bridges, etc. We advise all owners of such buildings which require painting to send for samples.

Hartshorn's Self-Acting Shade Rollers, 486 Broadway, New York. No cords or balances. Do not get out of order. A great convenience. Sold everywhere by the trade. See that you get Hartshorn's rollers. Makers and dealers in infringing rollers held strictly responsible.

The only Mechanical Device in existence for purifying water in steam boilers, is the Hotchkiss Boiler Cleaner Beware of imitators, they are infringers. Circulars free. 84 John St., New York.

Abbe Bolt Forging Machines and Palmer Power Hammer a specialty. S. C. Forsaith & Co., Manchester, N. H.

A competent and rapid Mechanical Draughtsman wants engagement. A. W. R., 76 E. 108th St., New York.

Wanted.–Most economical way of lifting water seven feet for drainage. J. S. Porcher, Eutawville, S. C.

Barber's Positive Rotary Force Pump. No sliding valves or abutments. The best and most durable pump made. For illustrated circular, address G. Lord, Manufacturer, Watertown, N. Y.

Blake's Belt Studs. The strongest fastening for leather and rubber belts. Greene, Tweed & Co., N. Y.

Baldwin the Clothier sends us the following notice, and desires to add thereto that Baldwin the Clothier is a patented trademark, and it is the exclusive property of O. S. Baldwin. Plagiarists and copyists take notice:

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To wit: Be it remembered, that on the 12th day of January, anno domini 1881, O. S. Baldwin. of New York, has deposited in this office the title of a Chart, the title or description of which is in the following words—to wit, "THREE THINGS," the right whereof he claims as proprietor, in conformity with the laws of the United States respecting copyrights. A. R. SPOFFORD, Librarian of Congress.

List 25.—Descriptive of over 2,000 new and second. hand machines. now ready for distribution. Send stamp for same. S. C. Forsaith & Co., Manchester, N. H.

Linen Hose and Rubber Hose suited for all purposes. Greene, Tweed & Co., 118 Chambers St., New York.

For the manufacture of metallic shells. cups, ferrules, blanks, and any and all kinds of press and stamped work in copper. brass, zinc, iron. or tin, address C. J. Godfrey & Son, Union City, Conn. The manufacture of small wares. notions. and metallic novelties a specialty. See advertisement on page 92.

L. Martin & Co., manufacturers of Lampblack and Pulp Mortar-black, 226 Walnut St., Philadelphia, Pa.

Foot Power Machinery for use in Workshops; sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Large Slotter, 72" x 18" stroke. Photo on application. Machinery Exchange, 261 N. 3d St., Phila.

Burgess' Portable Mechan. Blowpipe. See adv., p. 76.

Books for Engineers and Mechanics. Catalogues free. E. & F. N. Spon, 446 Broome St., New York.

Send to John D. Leveridge, 3 Cortlandt St., New York, for illustrated catalogue, mailed free, of all kinds of Scroll Saws and Supplies, Electric Lighters, Tyson's Steam Engines, Telephones, Novelties, etc.

Pure Oak Lea Belting C. W. Arny & Son, Manufacturers. Philadelphia. Correspondence solicited.

Within the last ten years greater improvements have been made in mowing machines than any other agricultural implement. It is universally acknowledged that the Eureka Mower Co., of Towanda, Pa., are making the best mower now in use, and every farmer should write to the manufacturers for catalogue, with prices.

Jenkins' Patent Valves and Packing "The Standard." Jenkins Bros., Proprietors, 11 Dey St., New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Wood Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 362 Dover St., Boston, Mass.

The Tools, Fixtures, and Patterns of the Taunton Foundry and Machine Company for sale by the George Place Machinery Agency, 121 Chambers St., New York.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House. New York.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited. Erie, Pa.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co., 52 Dey St., N.Y.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 50 Astor House, N. Y.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Stave, Barrel. Keg and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works. Drinker St., Philadelphia. Pa.

Presses. Dies and Tools for working Sheet Metal. etc. Fruit & other can tools. Bliss & Williams. B'klyn. N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

For Pat. Safety Elevators, Hoisting Engines. Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 60.

For Separators, Farm & Vertical Engines, see adv. p. 61.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 60.

For Patent Shapers and Planers, see ills. adv. p. 60.

The I. B. Davis Patent Feed Pump. See adv., p. 76.

Moulding Machines for Foundry Use. 33 per cent saved in labor. See adv. of Reynolds & Co., page 76.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 77.

Saw Mill Machinery. Stearns Mfg. Co. See p. 77.

The Sweetland Chuck. See illus. adv., p. 76.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor. Stiles & Co., Riegelsville. N.J.

Silent Injector, Blower, and Exhauster. See adv. p. 92.

The American Electric Co., Proprietors and Manufacturers of the Thomas Houston System of Electric Lighting of the Arc Style. See illus. adv., page 92.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 92.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

See Bentel, Margedant & Co.'s adv., page 92.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

Steam Hammers, Improved Hydraulic Jacks. and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

Frank's Wood Working Mach'y. See illus. adv., p. 92.

Eclipse Portable Engine. See illustrated adv., p. 93.

Peerless Colors—For coloring mortar. French, Richards & Co., 410 Callowhill St., Philadelphia, Pa.

Special Tools for Railway Repair Shops. L. B. Flanders Machine Works, Philadelphia, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 93.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 93.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 60.

Best Band Saw Blades. See last week's adv., p. 93.

Reed's Sectional Covering for steam surfaces; any one can apply it; can be removed and replaced without injury. J. A. Locke. & Son, 40 Cortlandt St., N. Y.

For best low price Planer and Matcher and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance. Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher. Schumm & Co., Philadelphia. Pa. Send for circular.

Penfield (Pulley) Blocks, Lockport, N Y. See ad. p. 92.

4 to 40 H P. Steam Engines. See adv. p. 93.

Tyson Vase Engine, small motor, 1-33 H. P.; efficient and non-explosive; price $50. See illus. adv., page 92.

Use Vacuum Oil Co.'s Lubricating Oil. Rochester, N.Y.

Wiley & Russell Mf'g Co. See adv., p. 60.

For Machineses Tools, see Wmtcomb's adv., page 73.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) W. R. E. inquires: Is there any process whereby we can recover the hydrochloric acid from a solution of chloride of zinc which we have as a by product in the manufacture of one of our colors? I can recover the acid from chloride of barium, by the use of sulphuric acid, but sulphate of zinc, being a soluble salt, does not precipitate in the same manner as sulphate of barium. A. We fear that there is no method short of an expensive and complex series of reactions and decompositions by which the hydrochloric acid could be recovered, and which would necessarily be too expensive to be profitable. From the fact that a solution of chloride of zinc possesses the property of rapidly decomposing sulphide of ammonium and the organic matter of miasmata which convey disease, it forms a valuable disinfectant and deodorizer, and we suggest the desirableness of the waste product alluded to being turned to account in this direction. Its value as a disinfectant has been thoroughly established.

(2) T. R. writes: In making a curve on a railroad, which rail is the highest, the inside one or the outside? Is it not the outside one that is raised, and the inside rail left level? A. Generally the outer rail is raised, but engineers differ somewhat in their practice. 2. Is it necessary to raise either where the speed is not over three miles an hour? A. No.

(3) G. E. P. asks: 1. What is the best cheap protection for rough wood work against fire (sparks and light flame inside of building)? A. Saturate the wood with a strong aqueous solution of tungstate of soda. 2. Which is the best, something applied like paint directly to the wood, or sheathing the same with sheet tin? A. The tin or sheet iron.

(4) C. D. A. asks: Is there any way to extract a portion of a glass stopper which has been broken off down in the neck of the bottle? A. Repair the broken glass by means of a little Armenian cement or stratena. (See SCIENTIFIC AMERICAN SUPPLEMENT, No. 158.) Then heat the neck of the bottle quickly but moderately, so as not to heat the stopper. The heat will expand the neck of the bottle so as to loosen the stopper, which may then be removed.

(5) J. H. P. writes: My neighbor has a medium sized hot air furnace with indirect draught, which he controls by check draught in smoke pipe, by slide in door at bottom of furnace, which when open admits air through the fire, and he also opens a space in feed door equal to four square inches, admitting air over the fire, which he claims is necessary to supply oxygen for the combustion of the coal gas. I claim that so much cold air passing over the fire is not only unnecessary, but to the expense of fuel, as in heating, cools the fire and the radiating surface of the furnace, lessens the degree of heat in the hot air chamber, and then passes through the flues into the chimney. I also claim that, as furnaces are commonly fitted, a closer approximate to the necessary amount of oxygen required for the combustion of the coal gas can be obtained through an opening to the fire from below, together with that passing to the fire through the joints to doors, than would result from opening a space to admit air directly to and above the fire. A. If the draught is good the introduction of a small amount of air over the fire may effect a saving in fuel, without decreasing the heat. With thick fires burned slowly, much carbonic oxide (CO)—a combustible gas is formed by the partial decomposition of the carbonic acid (CO_2), formed near the grate, in its passage through the body of fuel. If air is not admitted above the fire much of this gaseous fuel may escape unburned up the chimney. Your neighbor may therefore be correct.

(6) C. C. writes: The SCIENTIFIC AMERICAN SUPPLEMENT No. 253, contains a rule for estimating the horse power of a high pressure engine, by a practical engineer. But he does not give the *modus operandi* of obtaining the average pressure from expansion (except by the indicator). A. If you have no indicator, you can get the average pressure approximately by assuming that the entering steam has a pressure of 3 to 6 lb. less than the boiler pressure, and that this is the pressure in the cylinder until cut off; the terminal pressure will depend on the point of cut-off—that is, if cut off at one half the terminal pressure will be one-half the entering pressure—if cut off at one-third, one-third, etc. For example, suppose the boiler pressure 63 lb., then the initial cylinder pressure would be 60 lb.; and if cut off at one-half the terminal pressure, would be 30 lb.; and if cut off at one-third, 20 lb. Next add together the initial and the terminal pressures and divide by 2 the quotient is the approximate average pressure, $60+30=\frac{90}{2}=45$ lb. average and $60+20=\frac{80}{2}=40$ lb. average.

(7) C. D. N. writes: I made a copying pad after receipt in SUPPLEMENT, No. 225, using 18 ounces of glycerine and 3 ounces of gelatine, and maintaining the heat for about four hours, and in making the ink I used half on ounce aniline, half an ounce alcohol, and 3½ ounces of water, and I cannot take over 3 or 4 copies. What is the matter? A. Try an ink with less alcohol and more aniline violet. See that the latter is pure, not mixed with dextrine, as is very frequently the case.

(8) H. S. asks: 1. Why do engineers say 28 or 30 inches vacuum instead of pounds? A. 28 or 30 inches of mercury is only equal to 14 or 15 lb. Vacuum gauges are usually marked in inches. 2. Where is the most pressure in a boiler? A. The pressure at the bottom of legs is as much greater than that in the steam chamber as is due to the head of water. 3. Why are all gauges tapped into the drum? A. Gauges are usually located where most convenient for engineers.

(9) J. S. M. asks how to proceed to wear the inside of a steam cylinder smooth after it has become cut by running dry or from other cause. A. You can restore the surface by grinding out the cylinder with a true segment of lead and sand or emery, but great care must be taken that it is so done as to leave the cylinder true.

(10) E. F. R. writes: 1. I am building the hand power electric machine described in SUPPLEMENT, No. 161. Please tell me about how much No. 16 cotton covered wire it will take to wind the electromagnets. A. It will take about 1 lb. to each arm of the magnet. 2. What is meant by a resistance of two or three ohms? A. An ohm is the unit of electrical resistance, and is about equal to that of a pure copper wire one-twentieth of an inch in diameter and 250 feet long. 3. How are wires connected to the binding posts, etc., under the base? A. A screw provided with a copper washer passes upward through the base into the binding post, and clamps the wire between the washer and the underside of the base. 4. In making the induction coil in SUPPLEMENT, No. 160, shall I need 40 square feet of tin foil or 20 ditto; or, in other words, in counting the surface do you count both sides of a sheet? A. One side only is counted. Use 40 square feet.

(11) J. M. H. writes: 1. I wish to construct a telephone line of about one mile in length. Will the telephone as illustrated in Figs. 2 and 3, SUPPLEMENT, No. 142, work successfully on a line of that length. A. Yes. 2. What kind of wire will be the best to use for the line; will No. 14 galvanized telephone wire do? A. No. 14 will answer, but No. 12 would be better. 3. How is the silk covered wire fastened to the binding screws? A. The end is stripped and soldered to the heavy wire which is clamped between the shoulder of the binding post and the wood of the telephone handle. 4. Will the plate such as is used by artists for tin types do for the diaphragm. A. Yes. 5. Should the wire as used for the line be attached direct to the telephone? A. Yes. 6. Is the coil in the connecting wire, as shown in the engraving, necessary? A. No. 7. Must the spool be of the same size and dimensions as in the engraving? A. The size is correct, but may be varied somewhat without seriously affecting the working of the instrument. 8. Will it answer to attach the ground wire to an iron pipe that runs into a well, and how should it be attached? A. It would probably answer. Solder the wire to the pipe. 9. Would a bar magnet 9 inches long and weighing 15 oz., threaded at one end, answer any better in place of the horseshoe magnets and the iron core? A. No; the telephone with the three-eighths bar magnet is the best of the two forms shown.

(12) H. W. L. asks how to burn crude petroleum. Is it burnt in the same manner as kerosene, if not, how? A. Petroleum is a mixture of a large number of hydrocarbons, some very light, some heavy, all combustible. It is neither safe nor economical to burn the crude oil in a lamp or with a wick. For heating purposes the best results are obtained by the use of some form of injector which delivers the oil in a spray mixed with a large volume of atmospheric oxygen. Under such circumstances the combustion is nearly perfect, and the heat is intense.

(13) A. F. S. asks: What coloring matter is best for making transfer paper that will show plainly on black walnut? A. Try chrome yellow, or a yellow lake, made up with a sufficient quantity of melted lard and a little wax.

(14) A. T. G. asks how to make printer's rollers. A. 1. Glue, 8 lb.; molasses, 7 lb.; soften the glue by soaking it in cold rain water for 24 hours; then melt over the water bath and stir in the molasses previously heated, moderately. Heat gently for half an hour, with occasional stirring, let stand to cool somewhat and pour into oiled moulds. Requires from 8 to 10 hours in winter, and longer in summer, to harden. 2. Best white glue and glycerine, equal weights; soften the glue in cold water over night, then melt it over the water bath and gradually stir in the hot glycerine; continue the heat for seven hours, with occasional stirring, to drive off all the water absorbed by the glue. Let cool somewhat, skim and pour into well oiled brass moulds in the center of which the spindle is properly adjusted. Let it stand ten hours to harden before attempting to remove it. Large rollers require longer to harden than small ones.

(15) S. M. asks (1) for the name of a work treating on air pumps. A. There is a good article on the subject in Knight's "Mechanical Dictionary." 2. I desire to make bicarbonate of soda, and would like to get acid from my boiler fire, and think I might draw it by connecting a tight cylinder by a pipe with the fire and allow the carbonic acid to enter at top of cylinder and go to bottom of, say, four feet of water, and by pumping the air out of top of cylinder creating a vacuum, and thus causing the carbonic acid to flow in and wash it in passing through the water. A. The carbonic acid from the combustion of coal under an ordinary boiler contains much sulphurous acid and various hydrocarbons, beside this difficulty, the solution of soda must be kept cool to admit of the absorption of the gas to form the hydro (bi) carbonate.

(16) G. H. A. asks: 1. Would an ordinary oil stove furnish enough heat for a boiler large enough to supply with steam an engine large enough to run a steam carriage that would carry two persons on good roads? A. No. 5. How large an engine would be necessary? A. Probably 3 inch cylinder and 6 inch to 12 inch stroke, depending upon whether geared or not. 3. Would not a boiler built in the sectional plan be better (make more steam with less heat, and be safer) than an ordinary tubular boiler? A. Yes.

(17) W. H. C. asks for a recipe for an invisible ink so that it will only show when heated. A. Dilute a strong aqueous solution of pure chloride of cobalt with water, until, when written with, the characters are invisible after drying at ordinary temperatures. Heat develops a dark blue or purple color. Use a clean pen and sheet of blotting paper.

(18) C. G. asks: 1. Is it possible for feed water to enter a boiler too hot? A. No. 2. Since using a new system of heating feed water, we have been troubled with constant foaming of the boilers, and a gauge cock which is located in the side of mud drum shows at all times half water and half steam. We use river water, and clean out regularly, and until inauguration of heating water by this new system never had any trouble. The water is quite at 200° on entering the force pump. We enter at mud drum. What would be the effect of putting feed water in at water line or above? Give us your views, and tell us the cause of our trouble. A. We think that if you enter the feed water into the body of the boiler nearer the surface of the water you would be relieved of your trouble.

(19) C. D. R. asks: Will a boiler made from galvanized iron be strong enough to run an engine one inch bore by 3 inch stroke, for experiment? A. Yes, if the iron is of proper thickness; but galvanized iron is very poor stuff for the purpose, and should be thicker than if vulcanized.

(20) J. L. asks: What is the simplest way to find out the distance the tail piece on a lathe should be removed from its central position to turn a given taper? Supposing I have a piece of steel one foot long. taper required one-tenth of one inch to every inch, how far would I have to remove the center from its central position? A. Set over the tail center one-half the total taper in the whole length; if it is one-sixteenth of an inch difference of diameter in a piece twelve inches in length, set over the tail center half of twelve-sixteenths or three-eighths of an inch.

(21) C. J. H. writes: In making quantitative blowpipe assay of gold and silver ores, charcoal is

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recommended for a support in the first fusion of the assay. It is often quite difficult to procure good coals for the purpose, especially when on a prospecting trip. Is there not some kind of material from which small capsules can be made for the purpose, which can be used an indefinite number of times, and which would be equally as good as charcoal? A. We know of no support that will serve as a good substitute for the coal. A small bone ash cupel will answer in some cases.

(22) R. G. asks: 1. What is the weight of a foot of water in pipes from one-sixteenth of an inch to one inch in diameter? A. The weight of one cubic foot of fresh water is 62½ lb. and from this you can estimate the weight of water of any diameter and length of pipe. 2. What is smallest water meter under a 20 foot head that it would be possible to drive a sewing machine with at the usual rate of speed? A. You should apply to a maker of turbine wheels. The size depends upon the construction of the wheel and the manner in which the water is applied.

(23) A. W. C. writes: I have a coil of half inch steam pipe (iron) to be used for a boiler which opened in two places in the weld in coiling. Can you tell me how to repair it? A. Either braze up the opening in the pipe, or close it up as close as possible with a hammer and bolt a sleeve around it, with cement for a joint.

(24) L. K. S. asks: When were ships first copper bottomed? A. Fincham's history states that it was in the year 1553 that metal sheathing was first applied.

(25) C. D. W. asks in what cities on this continent other than horse power is used on street railways, also what power is used in cities you may name, whether steam, electrical, or compressed air? A. Compressed air engines have been tried in this city, but we believe they are not now in practical operation. At New Orleans, steam produced from highly heated water carried in tanks or fireless boilers is used. In San Francisco cars are drawn by endless ropes drawn by stationary engines, and we understand that Cincinnati is about to apply the same principle. In Philadelphia and in Brooklyn on many of the streets of the outskirts cars are drawn by steam locomotives of peculiar construction.

(26) E. H. A. asks: What is the weight of a blow given on a pile from a hammer weighing 1,700 lb. and falling 24 feet? A. 29·8 tons.

(27) "Cameo" asks whether a cameo is any kind of stone, cut in relief, or whether it is necessarily a precious stone. A. "A precious stone carved in relief."—Webster. "A precious stone or shell having an imitative design engraved upon it in bass relief, or figures raised above the surface."—Worcester.

(28) C. G. A. writes: I am about to construct some wooden trays with perforated bottoms, to hold fish eggs. They are to be placed in a tall pile, one over the other in the air, and be supplied with water in small quantity, which shall dip down through the whole series. I want a varnish or other preparation which shall be proof against the action of the water, and shall protect the wood from it and also prevent the wood exuding any hurtful juices. Is there any better mode than to varnish well with asphaltum? A. Give several flowing coats of good asphaltum varnish thinned with oil of tupentine somewhat and let them dry thoroughly before wetting.

(29) W. H. P. asks: 1. Can the electric light and other phenomena produced by a current from a Gramme machine be produced by the current of one or more induction coils? A. No. 2. If not, why not? A. Because the secondary current is of necessity intermittent and of very high tension. The machine referred to produces a quantity current which is requisite for the electric light.

(30) B. R. D. asks (1) how to proceed in the manufacture of aluminum. A. Alum is dissolved in hot water, a certain proportion of carbonate of soda is added, and the whole evaporated to dryness. In the manufacture of aluminum alloys this preparation is simply added to the metals—copper, tin, zinc, nickel, etc., fused in a covered crucible, and vigorously stirred in while the heat is continued, with care to exclude the air as much as possible. For gold colored aluminum bronze: 2 lb. copper is melted, and to it is added 1 lb. of the soda alum mixture and 6 oz. oxide of zinc. Cover, stir, and heat for about 15 minutes. 2. A foreign journal says: "1 oz. of charcoal, 3 oz. of salt, and 1 lb. of the oxide of aluminum put in a covered crucible and kept in the fire from 15 to 25 minutes at about 700° Fah." I wanted some to-day for an experiment, and failed. I inclose a sample of what I got. A. Too large a quantity of charcoal powder or too small a quantity of aluminum oxide (calcined) was used in your experiment. Reduce the materials to a powder that will all pass through a 90-mesh sieve, first having dried all thoroughly. Mix thoroughly, cover well in the crucible, and give a better heat. 3. Have I the right to make for an experiment? A. Yes. 4. What is the lifting power of the magnets in the best electric machines per horse power? A. Probably 200 lb. There is no fixed limit.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

S. H. H.—Chrome iron ore, worth ass aying.—A. F. B.—Nickeliferous pyrites—of some value.—T. P. C.—1. Lead sulphide (galena), argentiferous, in quartz and limestone. 2. Galena in limestone. 3. Pectolite—a lime potash soda silicate with a little galena. 4. Magnetic iron oxide—magnetite or loadstone. 5. Traprock. 6. Clay. 7. Quartzite.—F. B. M.—Sandstone—no value.—T. S. B.—Ferruginous sandstone—contains nothing of value.—G. M. W. and G. M. D.—An impure ocher. If ground and calcined would make a cheap pigment.—W. K.—1. Quartz carrying a small quantity of argentiferous sulphurets. 2. Gold quartz. 3. Quartz, gypsum, and iron sulphuret. 4. Micaceous and garnetiferous quartz. It carries a small quantity of copper and iron sulphurets, and some of it may be argentiferous. 5. Quartz, fluorite, and zinc oxide.

NEW BOOKS AND PUBLICATIONS.

AYER'S ALMANAC FOR 1881. IN ENGLISH, GERMAN, DUTCH, NORWEGIAN, SWEDISH, FRENCH, SPANISH, PORTUGUESE, AND BOHEMIAN. Published by Dr. J. C. Ayer & Co. Lowell, Mass.

We are in receipt of a neatly bound set of the various editions of Ayer's Almanac, as above, containing not only specimens of the languages above named, but also some pages of Turkish, Armenian, Greek, Bulgarian, and Chinese. The collection before us is a literary curiosity, and a remarkable example of enterprise and liberality. The annual edition is from ten to eleven millions, for free circulation.

SEWING MACHINERY. By J. W. Urquhart. London: Crosby, Lockwood & Co.

Gives a brief history of the principal sewing machine inventions, with details of construction and directions for adjusting the leading machines of the several types.

THE STATELY HOMES OF ENGLAND. By Llewellynn Jewitt and S. C. Hall. Two series in one volume. 8vo, pp. 399 and 360. New York: R. Worthington.

Thirty-one of the more notable of the historic castles, halls, and other "stately homes" of England are here pleasantly described and pictured by means of three hundred and eighty engravings on wood. The text is uncommonly good for a work of this class. The homes portrayed are rich in historic interest, many being ancient and all the seats of history-making families. The sketches were originally prepared for the pages of the *Art Journal*, but have since been considerably enlarged.

TOMLINSON'S HANDY BOOK FOR THE OFFICE AND HOME. Chicago: John H. Tomlinson. 8vo, paper.

The author has compiled from various sources a considerable amount of information and practical advice touching business affairs, social conduct, and so on.

MODERN ARCHITECTURAL DESIGNS AND DETAILS. New York: Bicknell & Comstock. Price $3.

Embraces plates 17–24. Low priced Queen Anne cottages, summer houses, and sea shore houses, with elevations, framing plans, exterior and interior details, and window sash.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

January 11, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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Furnaces for steam boilers, C. W. Doten, Boston, Mass.
Lasting machine for boots and shoes, S. B. Ellithorp, Rochester, N. Y.
Metallic packing, T. Tripp, East Stoughton, Mass.
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Shoe nails, manufacture of, J. Hitchcock *et al.*, Boston, Mass.
Spools or bobbins, supports for, W. S. Anchincloss, Philadelphia, Pa.
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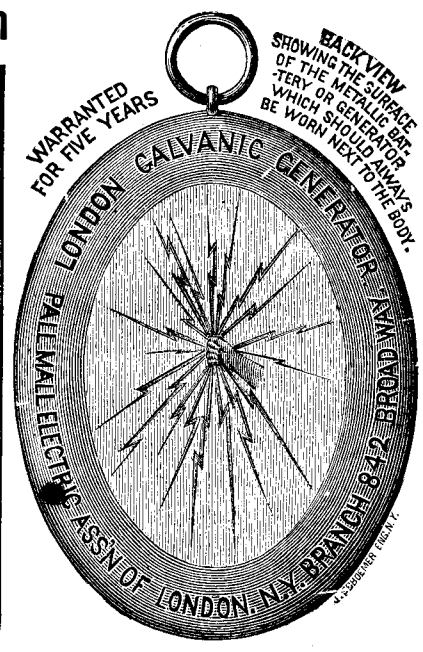
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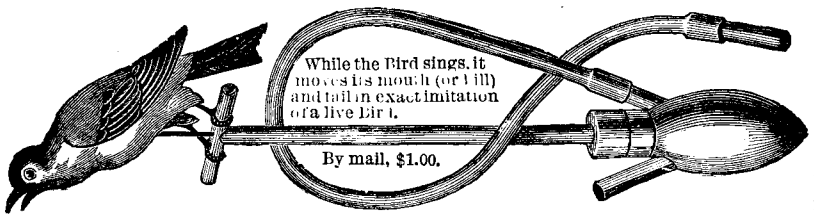

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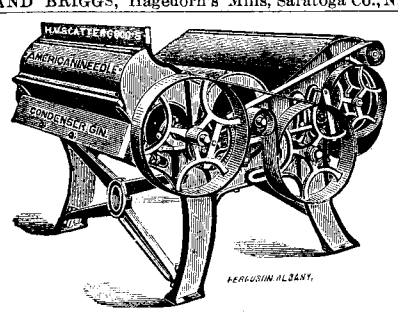

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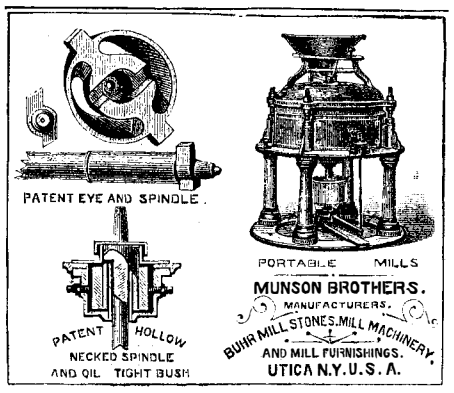
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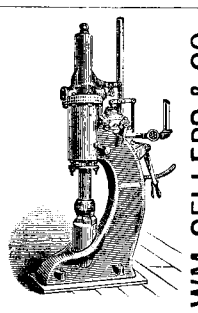

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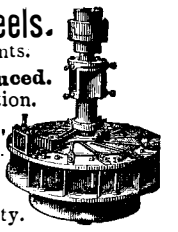

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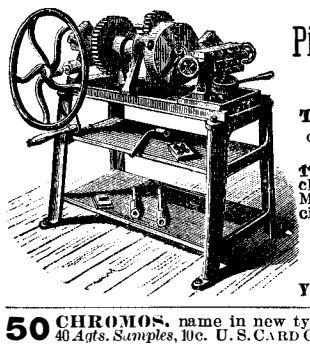

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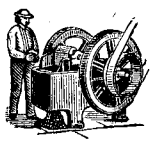

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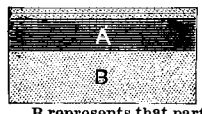

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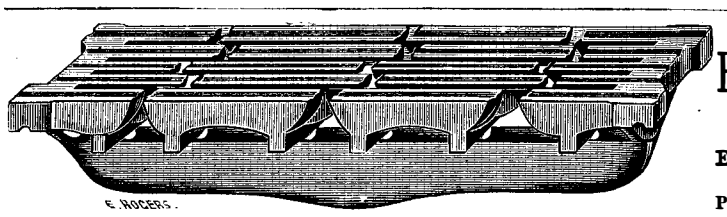

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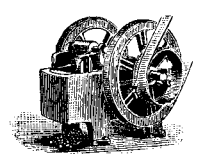

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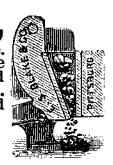

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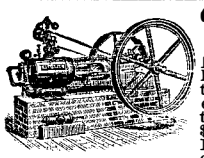

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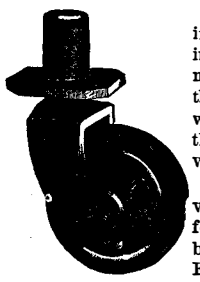

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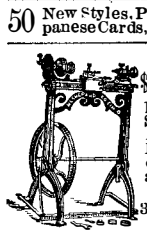

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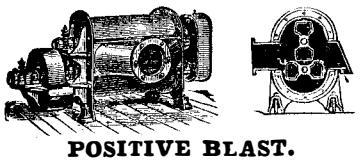

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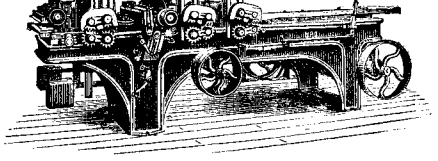

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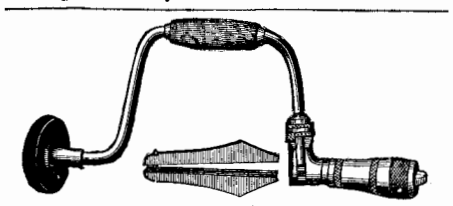

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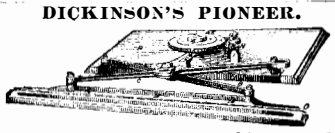

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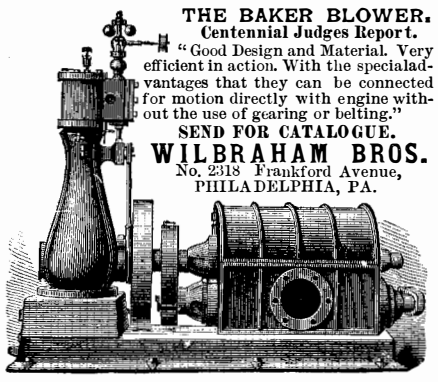

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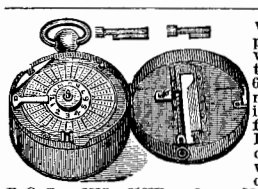

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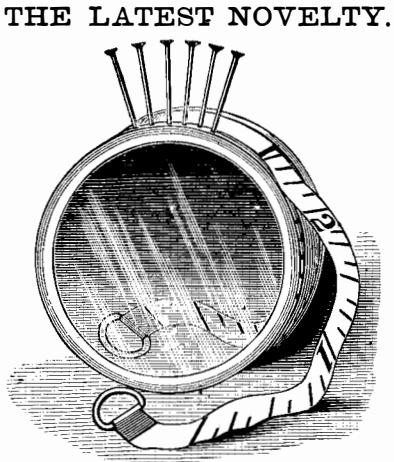

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